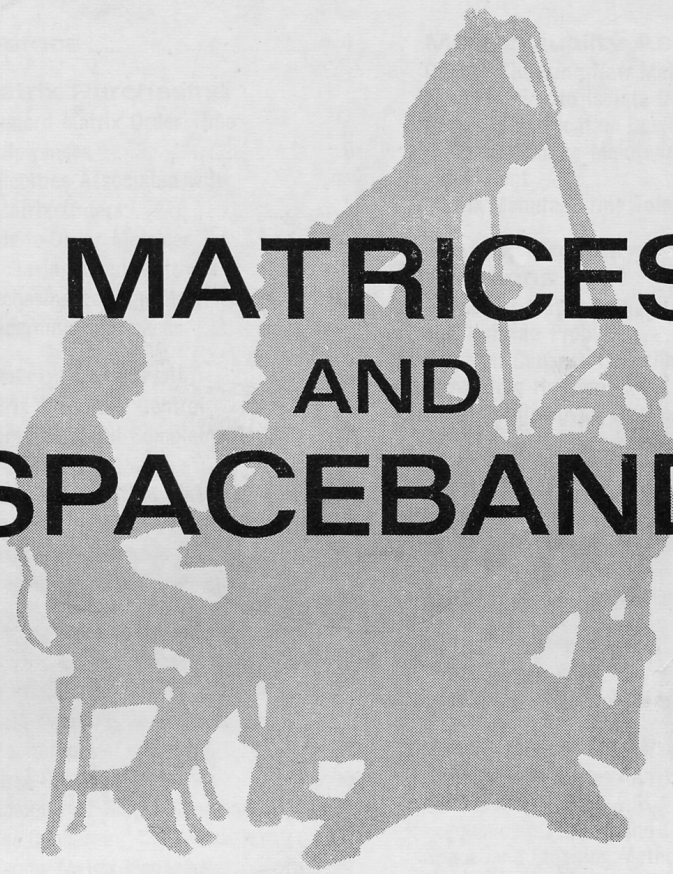

MATRICES AND SPACEBANDS

Lifeblood of the Linecasting Machine

INTERNATIONAL TYPOGRAPHIC COMPOSITION ASSOCIATION, INC.

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PREFACE

The greatest untapped resource in the world, said Charles Kettering, *is the untouched wealth within the group mind. If every member of every trade association were to agree to spend one hour a month contributing something to the group to which he belongs, a modern miracle would unfold before our doubting eyes.*

In publishing MATRICES AND SPACEBANDS, ITCA has again tapped the wealth of knowledge and experience within its ranks. The comprehensive, practical study which unfolds on the following pages tangibly manifests the spirit of conscientious cooperation that has always characterized our Association.

To the ninety-one typographic firms that found time to complete the extensive survey questionnaire that preceded this publication, we are extremely indebted. Appreciation is also directed to the ITCA Technical Research Committee, headed by Don Winsby (Winsby Typesetting Co., Inc.), for their valuable assistance from inception to completion of this important research project.

To those who use—and especially those who abuse—linecasting matrices and spacebands, we are hopeful that this manual will serve as a continuing source of information and inspiration.

ARTHUR E. GARDNER
Assistant Director

MATRICES AND SPACEBANDS deals with two wonders of the mechanical age – the circulating matrix and the tapered spaceband. The ingenious, unsophisticated principles upon which these two objects are based made possible man's liberation from the yoke of hand typesetting, and have served him well for the more than 75 years that have since transpired.

Because of their peerless role in typesetting activity, matrices and spacebands are, in a very real sense, the "lifeblood" of our linecasting machines. Their unrivaled importance has prompted and justified the preparation of this manual. Although not a maintenance text in the sense of furnishing schematic diagrams and specific adjustment techniques and tolerances, the contents of this report should provide a comprehensive and practical reference for all directly or indirectly concerned with linecasting matrices and spacebands. Wherever it was deemed appropriate, mention of Ludlow matrices has been injected into the text.

To a large extent, the material contained herein has been gleaned from the information provided, or sought, by responses to the extensive 1963 Survey entitled "Matrices and Spacebands." Ninety-one firms, representing a total of some 3,700 Typographic Industry workers and more than 500 linecasting machines, participated in the Survey. Because of their wide geographic distribution, their varied size – from two or three to more than 150 employees, and the general diversity of their operations, the attitudes and opinions contained herein reflect a very good, sizable cross-section of Industry attitude and experience.

It has been said that "with one foot in a bucket of ice water and the other in a bucket of boiling water, a person is *on the average* quite comfortable!" Although Survey statistics and percentages pervade the entire manual, their utility and importance must be kept in proper perspective. As in the case of our wet-footed friend, statistical averages can indeed be misleading if improperly interpreted or unjustly emphasized.

In order to thoroughly and methodically explore the wide range of pertinent, related subjects, the manual has been divided and sub-divided into appropriate categories. Each of these major or minor groupings treats one aspect of linecasting matrices or spacebands, and can be useful *per se*. In certain cases, however, it becomes important to explore preceding or following sections to obtain a complete coverage of the particular topic and its related aspects. The concluding pages of the manual contain a directory of related manufacturers and suppliers mentioned within the text.

The relatively high cost of matrices and spacebands, combined with their key role in determining or influencing typographic plant quality and efficiency, makes the content of this manual extremely important to every owner and user of linecasting equipment. Throughout the pages that follow, an attempt has been made to isolate causes and suggest avenues by which matrices and spacebands can be purchased, employed and maintained with the highest degree of precision and economy.

MATRIX PURCHASING

Standard Matrix Order Time Allowances

The time that elapses between the placement of an order for new mats (standard) and receipt of the mats has been a perennial source of discontent for a great many firms. In the course of our present study, 45% of firms explicity expressed dissatisfaction with slow speed and/or matrix service in general. Another significant group of firms implied some degree of related unhappiness. The direction of this discontent was rather evenly distributed between both major suppliers of linecasting matrices.

According to the figures submitted by Survey respondents, *mail* orders for new mats averaged 24 days. Broken down into percentages, 14% indicated 1 week or less; 16%, 1-2 weeks; 28%, 2-3 weeks; 17%, 4-6 weeks; 8%, 6-8 weeks; and 4% reported average elapsed times in excess of 8 weeks.

When compared to *phone* orders, it is of interest to note that mail orders averaged approximately *three times* as long. The elapsed time from the phone order for mats and their receipt averaged 8.5 days, although 69% indicated receipt in one week or less; 12% indicated 1-2 weeks; 11%, 2-3 weeks; and only 8% regularly experienced deliveries that exceeded a 3-week delay.

Apart from enabling immediate entry of the order, it was generally felt that use of the phone elicited more prompt attention since the degree of urgency (justified or unjustified) could be more effectively conveyed. Or, as one firm put it, "whoever hollers the loudest gets their mats first." Needless to say, this attitude serves to further compound an already difficult situation.

In addition to the effect of phone versus mail orders, there are other factors which exert some varying degree of influence on the time required to obtain new mats. These include: the proximity of the source of supply; whether or not the mats are in regular stock; the nature of the order, i.e., fonts, sorts, accents, etc.; the current backlog of orders; the family of mats ordered, e.g., popular faces usually more readily available; the extras that may be involved, such as bridge notching, referencing, contrasting, etc.; your willingness to accept a partial shipment; and, finally, the geographic location of your plant. Either individually or in combination, each of these factors will influence your experiences with any given mat order.

Assuming that the major suppliers of matrices do not intentionally generate discontent that might otherwise be avoided, a letter was sent to each asking, in essence, what the *customer* – the typographic plant – could do to reduce the time lapse between the placement and receipt of a mat order. Or, more generally, how might the *customer* help the matrix manufacturer to provide better service through mutual understanding and cooperation.

In response to this request, the following comment was obtained from Mergenthaler Linotype Company: "One of the most significant factors

which could improve our ability to provide faster service would be greater attention by users to anticipating normal and predictable needs on an orderly basis. Our experience is that many firms don't order until after the job is under way. When this happens, their need is most urgent. Every such call exacts a heavy penalty on the routine handling of all other orders in hand. The more such urgent calls, the slower the service on the remaining group.

"We believe that realistic inventorying of faces in a shop can substantially anticipate the large majority of requirements well before the actual moment of dire emergency. Not that *all* requirements are susceptible of prediction, but to the extent that they are, the extraordinary requirement is more readily handled by our facility.

"A simple plan of systematically building the special character and accent resources of a given type face or series can frequently permit a firm to channel type face selection into a face where the resources are at hand and can be handled without *any* emergency requirements. You would really be amazed, as we are, at the number of orders which come to hand calling for *one each* of a long list of rarely or never-used characters. A large number of orders which we handle are of a total value not large enough to cover the known cost of processing an order. These are the economic facts of life which we must daily face.

"It might help put this in proper perspective to point out that we provide service on nearly two million different characters. Small wonder that some of these are momentarily out of stock! Considering the entire matter of mat service, there must be ways in which together we can make it a more pleasant as well as more effective exercise. Perhaps even partial application of some of the ideas expressed here to the daily routines of matrices procurement would contribute materially to improving the situation."

Although you may justifiably take exception to some of what has been quoted here, there is a great deal of merit in some of the suggested avenues to better service. Maybe we can "cry wolf" a little less often with proper advance planning of our matrix requirements whenever possible.

Difficulties Associated With Matrix Orders

Apart from an almost universal malcontentment with time requirements, there were a number of other, more or less common, problems reportedly associated with the ordering of new and made-to-order mats. Those most frequently mentioned included shortages, i.e., partial delivery or incomplete filling of orders; alignment difficulties; depth-of-drive inaccuracies; mats out-of-stock or wrong font mats; and quads, spaces, dashes, etc., not being properly associated with the font ordered.

In the case of made-to-order mats, displeasure was primarily the result of poor communication in informing the engraver as to exact requirements and end use of the mats to be specially made. Other related difficulties seemed to arise from an incomplete understanding of customer requirements originally.

Suppliers may generate most of the "problems," but it must also be acknowledged that a significant percentage of the difficulties associated with mat orders are of a self-inflicted nature. Orders that are improperly or incompletely submitted often cause expensive delays that could have been prevented by care on the part of those who write the orders. According to one major supplier, over 4,000 different type faces and point sizes are obtainable, and each of these type faces is available in from 100 to

well over 1,000 characters. It is also of interest to note that matrices are supplied for composition in more than 850 languages and dialects. Suffice to say that this great variety of characters makes it essential that orders be prepared very thoroughly and accurately.

Although some firms have found it convenient to use their own order forms, it is normally more efficient to use the regular or special order forms provided, and follow the instructions given, by the matrix suppliers. These forms generally serve as a good check list of all the factors that must be specified, such as: Model of machine; kind of magazine; mixer notches, if any; keyboard diagram; whether fractions are to be em or en, pi or keyboarded; kind of figures; type of leaders and spaces required, etc. Depending on the particular order, there may be a great many specifications necessary to fill the order promptly and without error. In addition to the foregoing instructions, it is important to *specify* whether the shipment is to be by freight, express, parcel post, air mail or air express.

Assuming a matrix order has been properly specified and filled, the matter of inaccuracies often enters the picture. In some cases these can be attributed to inconsistencies or defects in manufacture or subsequent inspections. On other occasions, however, the supplier is unjustly blamed. By way of illustration, many alignment "defects," are the result of combining old and somewhat worn mats with new mats. Apart from wear, various machine inaccuracies or maladjustment can also create difficulties with new mats, despite the fact that no problem was apparent with older mats. The explanation for this "phenomenon" will be explored in greater detail in subsequent sections of this report.

As a final word, the suggestion has been advanced that matrix suppliers be encouraged to furnish a font proof with each order of new mats. Although this would not eliminate the necessity and practicality of doing this when the mats were received by you, it could no doubt reduce the number of defective mats, and debates as to mat accuracy. According to the informal comments made by one major supplier, it was felt that such proofs would not add substantially to the product, but would no doubt further delay shipments and increase matrix prices.

Subsequent investigations will be continued, in conjunction with the major matrix suppliers, to determine and initiate mutually practical means by which mat services can be improved. In the interim, you can no doubt improve your own situation by applying some of the recommendations made previously.

Made-to-Order Matrices

Few firms, if any, have not had the need to obtain special characters, accents, logotypes, etc., made-to-order. Normally, these must be obtained with a minimum of delay and a maximum of accuracy. There are today a large number of reliable sources for such mats.

Among the more than 90 firms responding to the Survey, 13 *different* sources for made-to-order mats were reported. The top three, with 45%, 25% and 9% of the totals were, respectively, Mergenthaler (including 5% from Canadian Linotype), Intertype and Service Engravers. Other sources included J. J. Edwards (5%), Ludlow Typograph (4%), Oscar R. Kolen (4%), and Conti Engravers (2%). The following suppliers of made-to-order mats were reported by one firm each: Baltimore Type & Composition, Modern Matrix Co., Wiebking Engraving, Hedman Corp., Albert Hausman, and Progressive Brass Die Co.

The source you find best may be influenced by the nature of your

special mat requirements. A number of suppliers, for example, limit their service to the engraving of accents on mats furnished by you. For this reason, more than half of the firms reported several sources for made-to-order mats.

All sources considered, only 9% of firms reported any unsatisfactory experiences with suppliers of special mats. The two major facets of this discontent involved slow delivery and high cost, in that order. Based on information furnished by suppliers, some of the discontent could be eliminated by being more precise in the copy and specifications submitted. Where new mats are being made the engraver must, for example, have complete information as to standard or non-standard alignment requisites.

Although certain firms advertise "same day" service on small orders for engraved accents, only a very small percentage of firms reported receiving such rapid service. Influenced, of course, by the size and complexity of the special matrix or engraved accent order, elapsed times reported ranged from same day to 6 months! The mean average was 25 days. Of the total firms reporting, 25% indicated receipt of special mats within one week or less. And, only 6% received their orders in three days or less.

The increased use of reproduction proofs, combined with the insatiable demand for faster service, has continued to reduce the necessity for special accented mats, etc. In many cases these unusual necessities are drawn onto the proof or artwork. This saves not only time, but also the relatively high cost of these special, limited application mats.

When made-to-order mats are required, however, it is essential to anticipate your complete requirements as early as possible. Also, it invariably is quite helpful to obtain a specific delivery date commitment from your supplier.

Purchasing Used Matrices

Although 29% of firms reported sometimes purchasing used mats, only 1 out of 5 members has ever bought used mats with *complete* satisfaction. Experiences among firms exercising a high degree of precaution were substantially more successful.

The largest single source for used linecasting mats is mat dealers. Auctions and liquidation sales followed closely behind, and only 7% were obtained from other sources. Of the mat dealers involved, Midwest Matrix and Machinery Mart, Inc. was most frequently reported. Other dealers included: Mats, Inc., Matrix Mart, and Type & Press.

Among those firms who do not purchase used mats, or have had very unsatisfactory experiences, it was generally felt that the high quality of the typographic plant product could not tolerate the defects, inaccuracies and other limitations often associated with used mats. The old adages that "you usually get what you pay for," and "why buy someone else's troubles," were held in high esteem by this group. On the other hand, those who have had considerable good fortune attribute their success to the great care exercised in their purchases.

If you are inclined to purchase used mats, the risk can be minimized by exercising the following precautions:

(1) Know who used the mats previously.
(2) Check casting (in both positions) and distribution *in your own plant.*
(3) Repro proof (preferably on high gloss stock) and carefully inspect under magnification for hairlines, misalignment and depth-of-

drive problems. (If added to an existing font, proof the *entire* font including the used mat additions.)

(4) Inspect the mats themselves for defects and wear. Lugs (toes in particular) give the best evidence of usage, damage or poor maintenance.

(5) Make an accurate mat count.

(6) Spot check with a micrometer to insure they have not been "shaved" to temporarily eliminate a hairlining problem.

(7) Let someone who knows mats, e.g., a reliable machinist, influence the decision as to their value.

(8) Lastly—*and most important*—purchase on approval only! Mats must be guaranteed returnable if not satisfactory after the above precautions have been exercised.

As a final comment, the *cost* of *thoroughly* checking and testing used mats must be realistically considered in terms of the differential between the cost of the used mats and comparable new mats.

Purchasing Foreign Mats

In recent years, there has been a growing preoccupation with foreign faces, largely generated by advertising agencies and the like. Our data indicate that 12% of firms have purchased some foreign mats. The source for most of these imports, which are largely German and Italian, has mainly been through Mergenthaler and/or Intertype.

Further evidence of the growing demand for imported mats was evidenced during the past year when Midwest Matrix and Machinery Mart obtained an exclusive U. S. distributorship for Simoncini, Inc., Italian manufacturer of linecasting matrices.

Although few firms have been using foreign mats long enough or in sufficient quantity to have conclusive experiences, it is generally felt that the performance and workmanship in these mats is extremely good. However, a number of firms have indicated delays up to 6 months in obtaining imported mats. Because of the necessity to import these faces, the processing is necessarily longer. And, by the same token, handling errors, shortages or other mistakes in ordering take longer to rectify.

According to Mergenthaler, "orders for such faces should take into account that six or eight weeks is the bare minimum to handle. Overseas telephoning is costly and frequently ineffectual due to time differences and language problems, and should be avoided by proper planning."

Concerning Hairspaces

For close hand-spacing in narrow measures, as a help in making odd justifications, and to achieve optical spacing perfection, etc., the typographic plant considers hairspaces essential. The discriminating buyer – *and producer* – of typography finds their proper use invaluable, despite the additional cost and effort required.

Every firm uses hairspaces, although the number of different thicknesses varies from firm to firm. Reports indicated a wide range of from one to eight. The average typographic plant has slightly less than 4 different thicknesses of hairspaces available. Those firms using either 3, 4 or 5 kinds represented 83% of the total.

The term "hairspaces" is limited to those spaces which do *not* have combination teeth and are inserted in the line by hand. Hairspaces normally range in thickness from ¼ point (.0035") to 1½ point (.021"), and can be obtained in as many as twelve intermediate graduations. Normally, however, the most common widths are in multiples of ¼

points. Regular brass thin spaces, or pi thin spaces, generally start at 2 point (.0277").

The materials of which hairspaces are made include various forms of steel, brass, copper, bronze, aluminum and certain alloys. Most commonly, steel is used for ¼ and ½ point spaces, while brass is associated with the thicker hairspaces. In terms of frequency of use, 1 point (.0138") hairspaces are most popular, followed closely behind by ½ (.0069") point and 1½ (.021") point. Firms using ¼ point spaces constituted 9%, and only 5% indicated having ¾ point spaces available.

Nine different suppliers of hairspaces were reported. The major source was Mergenthaler Linotype with 33% of the total. Star Parts, Intertype, and D. W. Morgan followed with 17%, 16% and 15%, respectively. Other suppliers included Ad Space Products (8%), Rich & McLean (6%), and Seymour M. Rabin (3%). Richard R. Hammill and A. E. Heinsohn were reported by two and one firms, respectively. All of these firms considered, no dissatisfactions were expressed. There was, however, an indication of substantial variance in cost between suppliers.

Unless they are notched for purposes of identification, it is convenient and practical, when ordering hairspaces, to have the body thickness marked on the side. To use hairspaces intelligently and effectively, it is important to have an ample supply for *each* machine – particularly ½ point and 1 point sizes. And, finally, where extensive hand-spacing is required, it is often easier to use the duplex rail while putting them in. When the line is ready to go you flip them off the rail.

MATRIX CONTROL

Matrix Inventory Control

In conjunction with the question – "Do you maintain a current inventory of all mats in the plant – kinds, sizes, quantities of each character, etc.?" – only 26% of firms responded affirmatively. Another 29%, however, answered "no, but we should." Among the remaining negative replys, a number were qualified by stating that the inventory was not always current, or that it was limited to certain fonts rather than being all-inclusive.

Although not maintaining a matrix inventory per se, a significant group of firms indicated the use of specimen books or matrix specification listings as the basis for exercising control over the current availability of mats in the plant. Specifically, by purchasing full or split fonts according to a particular font scheme (standard or original) plus certain extras, and then keeping these fonts full, they are able to maintain a reasonably accurate mat inventory.

The next two sections will cover both the maintenance of a full complement of mats in each font, and the matter of matrix specification listings.

Maintaining Full Complements in Fonts

Only a small minority of firms indicate a methodical, periodically employed system for insuring that the quantity of matrices in each font is maintained at the appropriate standard capacity. The greatest number of plants take action *after* a shortage has been noted. And, too often, production efficiency remains impaired until replacements are ordered or otherwise obtained.

A large segment of firms indicate making their font counts (font proof) during idle or otherwise slack periods. Others do so periodically

whenever mats are cleaned or checked for hairlines, misalignment, etc. Suffice to say there should be a regularly established procedure to minimize or completely avoid production problems resulting from mat shortages.

Although the situation will vary from plant to plant, you will no doubt find one or more of the following suggested methods of practical value in your operation:

(1) At the start of each shift, a font proof is taken by each operator of the font in use on his first job assignment. *(Note:* Font counts are perhaps best made by assembling mats spaced by fives.)

(2) Cast and proof heavily used fonts *daily* to check for wrong fonts as well as shortages.

(3) Use a special "Record Want Book" to keep a cumulative record of damaged or defective mats. Order new mats in sufficient time to avoid production delays due to shortages.

(4) If you have one, use your current "Inventory Catalog" as a control. Order when quantities begin to approach your established minimum standards.

(5) Accumulate mats taken out of service, then gang them and send in a replacement order on a regular periodic schedule.

(6) Instruct machinists and/or operators to visually inspect (or use a "counting stick") magazine channels from the roof at every machine set-up or magazine change – especially the first two channels of lower case.

(7) Establish a routine by which operators are specifically charged with the responsibility of immediately reporting any mat shortage to the foreman or machinist. Mat shortage slips – or even type slugs – can be used to record the short mat or mats.

(8) When any shortage is noted by operators, or proofreaders as well, a font count should be taken immediately, and necessary mats promptly ordered to bring font to standard capacity. Whenever a defective mat is discarded, at least its channel should be automatically checked for quantity.

(9) Prior to all large jobs, it should be standard practice to font proof for quantity as well as mat condition.

(10) On commonly used fonts, make replacements from sorts on hand. Establish minimum sorts requirements as a basis for ordering additional replacements.

In response to a related question, 44% of firms—of all sizes—reported keeping some supply of common replacement mats for all frequently used machine faces. And, slightly more than half of these firms required a mat-for-mat replacement as soon as any mat was taken out of service, rather than allowing shortages to build up until the operator finds himself waiting for mats to drop.

It is realized that the number of fonts in use, and the high cost of mats, must keep sorts inventories to a minimum. Several firms have found it practical to keep sorts only for the first two keyboard rows and points. The necessity to keep a library of sorts on hand will also be influenced by your access to a source for new mats and the service you normally receive.

It is always a good idea to purchase some replacements with each new font. This can avoid the alignment problem that sometimes results when later ordering replacements. Finally, it is wise to always maintain full channels, particularly in your frequently used magazines. By lengthening the rotation of mats, the life of the font is thereby extended.

Matrix Specification Listings

Although the format and complexity may differ from plant to plant, every firm needs a reference to quickly provide pertinent data concerning all available linecasting fonts. However, it has been found that only 60% of firms actually have a listing of matrix specifications, or at least some semblance of an all-inclusive matrix identification system.

The most frequently employed technique for maintaining a record of matrix specifications is the composite listing in a tabular format. These may range from large wall charts to letter-size or galley listings set in a rather small size. The listing itself may be: Organized according to point size (i.e., all 6 point faces; all 8 point faces, etc.); organized by ascending font identification numbers; or organized by plant designated magazine numbers. Generally, the alphabetical listing by face names, and then sizes available in each face, is somewhat more frequently used than the other common practice of listing in point size groupings. Interestingly, some larger firms have both systems available as a cross-reference.

Certain plants reportedly have found card files effective, while still others prefer a looseleaf ledger, or side-stapled format that enables proofs of fractions, accents, and other miscellaneous characters to be included with the basic specifications for each face and size. In a few cases, a series of individual sheets was used to supplement the concise specification table.

In a very limited number of instances, type specimen books or mat catalogs were being used to enter pertinent specifications. Two firms reported affixing mat specifications on gummed labels to the front and sides of magazines. And, one plant described the use of individual cards for each font, contained in holders on the magazine racks. (An accompanying holder is used to accumulate mats to be run in next time the magazine is used.)

Suffice to say, the best format is the one that proves most effective in *your* operation. To be practical it must be tailor-made to your own requirements.

Matrix specification listings run a very wide gamut in regard to content. While some contain little more than font code numbers and perhaps leader style, others are highly detailed to include such matters as alphabet length or an indication as to the last cleaning of the magazine and mats.

Although not all of the following possible contents of a listing of matrix specifications will have universal application or need, you can readily isolate the information that would be useful in your plant.

(1) Point size and *full* name of each face. (Clearly indicating particular combinations, e.g., with italic and small caps, with bold, etc., and whether the font contains one or two-letter matrices.)
(2) Standard abbreviations you use for mark-up purposes. (E.g., GAR for Garamond, MB for Memphis Bold, etc.)
(3) Font code number or triangle number. (Specify whether mat number is Linotype or Intertype, and indicate comparative numbers on interchangeable faces.)
(4) Location and/or designation of each magazine and its related sorts.
(5) Number of magazines available in each face and size.
(6) Kind and/or style of leaders, fractions, special dashes, etc. for each font.
(7) Availability of accents for each font.
(8) Size of figures in thousandths.

(9) Code markings to indicate such factors as lining and/or old style figures, and long and/or short descenders.

(10) Quads and thin space numbers and/or set widths (micrometer thickness).

(11) Bridge notch numbers, where applicable. (Color code may be used if corresponding labels or markings are used on magazines to indicate mixer notch.)

(12) Matrix contrast reference color and linescribing designation. (A supplemental list might indicate all fonts using each color.)

(13) Date font was purchased, and the particular font scheme selected.

(14) Alphabet length in points, and possibly characters per pica.

(15) Finally, space might be provided to indicate the last time each magazine and its mats were cleaned.

A comprehensive listing of matrix specifications—carefully prepared and conscientiously maintained—is of invaluable assistance both in the efficient control of mats and in the reduction of time spent *haphazardly* looking for matrix specification information.

Identification Markings on Matrices

Directly related to the matter of matrix specifications, the actual matrix markings or identification systems in use are worthy of separate comment. Although matrix contrasting and linescribing provide a means of identification, we are presently concerned only with the symbols used by the mat manufacturers. Contrasting will be considered in detail in a subsequent section.

Responding to the question: "Do you feel manufacturers' matrix identification systems are in need of revision?"—more than 75% indicated some degree of dissatisfaction with current procedure, or suggested some means of improvement. By far the two major sources of discontent were the lack of consistency in the numbering of fonts and the inadequate identification of quads, leaders and thin spaces.

The advantages of having all sizes within a particular series identified by the same face number are readily apparent. For example, this would enable the use of font numbers in conjunction with mark-up, as is now done with many Monotype faces. Although Mergenthaler has been making some progress in font number standardization, a great deal more effort must be expended in this direction.

Regarding the matter of uniformly identifying quads, thin spaces and leaders, Intertype does mark all such mats in a font with the appropriate font number. A significant number of firms have, however, expressed a high degree of dissatisfaction with the lack of relationship spaces and leaders often have to the Linotype fonts in which they are included. In addition to correctly marking these mats according to their related font numbers, the utility of having spaces and leaders stamped with their respective micrometer widths was also widely desired.

Other comments regarding matrix identification difficulties or suggested improvements included: Deeper punching or contrasting of identification numbers to make them more easily discernable; more uniform application of face lines on bottom of mats; linescribing of reference face of two-letter matrices so that differing point sizes could be easily distinguished in the assembling elevator; and, such other matters as greater consistency in the identification of long and short descenders.

With the hope that some of the expressed difficulties and proposed improvements to matrix identification can be remedied or accomplished,

the major suppliers of linecasting mats have been advised of our findings in this regard.

Matrix Font Schemes

Generally, the font schemes provided by the leading suppliers of linecasting mats are considered quite satisfactory. Only one out of every six firms expressed any dissatisfaction or desired improvement. It was, however, frequently noted that the typographic plant will often have to modify a basic scheme or develop a new scheme based on the particular use to which a font may be put.

Both Mergenthaler and Intertype have developed an extensive variety of suggested font schemes based on diversified composition requirements. Arranged in tabular format to facilitate comparison, each manufacturer explains the various font distinctions, quantities of matrices in the total font and of individual characters, and specific advantages of the various schemes. Individual font schemes to meet specific operating conditions normally can be easily developed by coupling different groups from the basic and supplemental (pi or sort characters) categories that are outlined.

Based on plant experiences, preferences and needs, a number of firms report always developing their own schemes, and have printed personalized order forms to specify their particular requirements. One firm, for example, usually patterns their mat orders on foundry type schemes. It was generally agreed, however, that to efficiently meet the requirements of a wide variety of work, it is wise to start with approximately 1500 mats.

With the thought of extending the adequacy of basic schemes, it was suggested that allowance be made in some fonts to permit the inclusion of simple equation mats; that the relationship of caps and figures to lower case be reconsidered in straight matter schemes; and that the frequency of individual character usage should be further studied to make such scheme changes as may be necessary to more accurately reflect these frequencies.

Considering the infinite variety of individual predilections as to what constitutes the best possible font scheme based on certain specific requirements, it is of course extremely difficult for matrix suppliers to fully satisfy every customer. To a large extent, it is generally agreed that present schemes are as practical and varied as is possible for universal application.

Controlling Pi Matrices and Sorts

In far too many plants "haphazard hunting" for pi mats and other miscellaneous sorts is a persistent source of wasted time and effort. Regardless of size, every firm is faced with the necessity of maintaining a variety of mats in excess of those contained within magazines. The degree to which these supplementary mats are methodically stored and indexed will determine the speed and efficiency with which they can be secured when needed.

An infinite variety of standard, custom and homemade trays, boards, drawers, boxes, etc., is being used as receptacles for supplementary mats. Regardless of the container, if it enables systematic organization and positive location of mats as required, it is serving its purpose. Normally, it is best to select storage cabinets specifically designed for the purpose. A wide variety of these is available through matrix and related equipment suppliers.

Devising a practical system for storing supplementary mats will be influenced by the nature and quantity of the mats involved. Pi mats associated with a particular font will require different handling than universal pi mats common to all fonts. And, sorts consisting exclusively of replacements for standard mats are no doubt best maintained apart from such specific font sorts as long or short descenders, or other such variants.

By far the majority of firms utilize a pi mat and/or sorts drawer for each font. In addition to such identifying information as font name and number, size(s) contained, etc., each drawer normally has a location number corresponding to the font's magazine number. Where storage facilities do not permit, or quantities do not warrant, supplementary mats are placed in drawers alphabetically according to faces, and then broken down into rows according to point size.

Universal pi mats common to all fonts are ideally stored in special drawers properly labeled "Mathematical," "Greek," "Ornaments," etc. Within each such category, the mats are then organized according to point size. Where quantities do not justify individual drawers, similar mats should nevertheless be kept associated.

Although plant layout and frequency of usage will influence the location of supplementary mat cabinets, it is important that they be easily accessible. A number of firms have located these pi mats and sorts in racks above the magazines and as close as possible to the particular magazine to which the mats relate. Certain standard pi and commonly used typographic spots are often advantageously stored at each machine.

It is most important that all sorts and pi trays be uniformly arranged in a predetermined pattern so that operators will immediately know in which section or row of a tray to find accents, fractions, etc. Steps must of course be taken to insure that mats are always returned according to the same scheme. A limited number of firms have indicated the use of color codes to assist in locating various categories of supplementary mats.

To further assist operators in locating mats without delay, it is extremely valuable to proof and catalog all pi mats and sorts according to location. A copy of this index can then be made available to each operator. Having a proof of the contents on each individual tray will also measurably assist the operator in locating mats.

The best conceived system for handling pi mats and sorts will fall short unless the responsibility for maintaining the system is specifically delegated. Ideally, one person should have this responsibility. As one firm reports, operators are required to put their personalized "filler blocks" in mat trays to indicate that one or more mats has been removed. All replacements are then done under the exclusive control of a single individual.

In practice, operators normally take an entire pi or sort drawer to their machine. In this case, it becomes extremely important that mats and trays are returned to storage *immediately* after being used. Even under this arrangement, it is essential that the machinist, or some other person, be charged with the responsibility of insuring that no carelessness or laxity disturbs the system of storage and retrieval.

Wasted time looking for necessary pi mats and/or sorts very quickly pays for the added supervision time or additional trays and cabinets required to methodically store and effectively control the use of these supplementary mats.

MATRIX MAINTENANCE

Matrix Cleaning Techniques

The importance of maintaining the cleanliness of matrices cannot be stressed too strongly. Since succeeding sections will consider in detail some of the pitfalls of unclean mats, it will now suffice to say that matrix cleanliness is deserving of very careful, continuing attention.

A great many problems associated with matrices would be eliminated, or at least very substantially minimized, if the excessive use of graphite was avoided, if mats were handled as little as possible and never with greasy fingers, and if excessive oiling of machine parts was avoided. Beyond these more obvious causes of matrix contamination, there are numerous other less controllable ways in which mats become sufficiently dirty to require periodic maintenance.

Considering the three basic methods by which matrices are being cleaned, it has been found that the vast majority of firms continue to use simple, dry methods of hand cleaning. Matrix cleaning machines were reported by 18% of firms, and only 6% indicated the hand use of any liquid matrix cleaning agents. Interestingly, one firm mentioned their very successful experimentation with an ultra-sonic cleaning device that had been adapted for the purpose of cleaning linecasting mats. A small percentage of firms indicated having mats cleaned by outside sources in conjunction with matrix contrasting services.

It should probably also be noted that there exists a small school who do not believe mat cleaning is necessary. Ideally, they feel that one side of the matrix is kept rather clean by its travel down the assembler belt. The other side of the matrix is somewhat cleaned by the wipe it receives from the adjoining matrix as it is elevated to the distributor screws in the distributor box.

In responding to a question concerning the various parts of the mat which are cleaned, 55% indicated lugs (toes and ears) only, 25% indicated the entire mat, and 20% of firms reported cleaning the entire mat *excluding* the sidewalls. Since cleaning machines and liquid agents cannot be wholly selective in their cleaning, these figures generally refer to firms using dry, hand cleaning methods. Whether or not mats are contrasted may further influence the parts of the mat which can be safely cleaned.

Three out of four firms note the use of a special mat holder in conjunction with matrix cleaning. Of those firms not using a mat holder, 40% indicate the use of a galley to retain mats while cleaning. Two firms even reported using an old second elevator rail to hold mats while burnishing. Although specialized holders range in capacity from 10" to 36", the most commonly reported sizes were 14, 18, 12, and 15 inch, in that order of popularity. These are available from a variety of sources, and virtually all expose the lugs and reference sides of the mats.

Unquestionably, the best method of mat maintenance is *preventive* maintenance. By handling mats as little as possible, by running machines as dry as practical, and by insisting on good housekeeping habits, the necessity for matrix cleaning can be significantly diminished.

Dry Methods of Cleaning Matrices

By far the most commonly used method of matrix cleaning, dry techniques generally involve the use of rubber erasers and/or motorized brushing with a fine wire buffer wheel. Often based on previously unsatisfactory experiences with cleaning machines or liquid washes, the

majority of firms still continue to use these dry methods with generally good results. Only 7% indicated any degree of dissatisfaction.

Considering only those firms using dry methods, 52% report wire brushing, 44% indicate rubber erasers, and 4% mentioned the Clean-A-Mat device available from Fisk Industries. It is of interest to note that more than 20% of these firms indicated using *both* rubber and wire brush techniques when deemed appropriate.

Of the rubber cleaners reported, Dixon's Kwic-Kleen Mat Reference Rubber was in most common use. Standard electrotyper's rubbers followed closely behind, and a variety of other types of hard and soft erasers were mentioned. For best results, a rubber should be neither too hard nor too soft.

Several firms using rubber erasers to clean lugs report stretching a piece of fine cloth over a board and then lightly rubbing both sides of the matrix on this. It was felt, however, that such cleaning should not be necessary too often unless mats have been inadvertently contaminated with greasy dirt or oil.

Concerning the use of compressed air in conjunction with cleaning, nearly ⅓ of firms report so doing. Generally, the air is used to remove rubber particles that accumulate when an eraser is used. It should be noted that the compressed air must be completely oil-free or added problems will develop.

Liquid Cleaning Compounds and Techniques

Despite the fact that many authorities have long advised against the use of any liquid washes on mats, the practice continues to exist to some extent within a relatively small number of firms. And, most of these firms are apparently doing so without deleterious effect to the mats.

Of the firms indicating the hand use of oil-free, liquid cleaning compounds, Matriceen (Hutzler) was reported by 45%, while Kleenwell (Star Parts), carbon tetrachloride, and various unidentified detergents each received 9% of the total. Other agents included white gas, naphtha, benzine, type wash, etc.

Because of their particularly poisonous nature, carbon tetrachloride and benzine should not be used. It is also well to remember that mats should never be cleaned with any liquid solvent containing chromic acid. This acid is a brass solvent, and even a weak solution will pit characters and destroy sidewalls. Although it is regarded as a satisfactory, non-damaging cleaning agent, Matriceen was reported by several firms to have removed the color from contrasted mats. It should be noted, however, that this difficulty may be a function of poor contrasting rather than the fault of the liquid cleaner.

A group of firms indicated having at one time tried various liquid cleaning compounds that were effective and did not damage mats, but had discontinued because the liquid had removed the "false sidewall." Most users of "dry" mat cleaning methods do so to maintain this false wall which supposedly replaces a worn or damaged sidewall and protects against the occurrence of hairlines.

Although this matter of "the wall" will be considered in some detail later, it might be noted that matrix cleaning liquids will no doubt remove the intermediary graphite false wall that precedes the development of a complete type-metal sidewall. Normally, liquid cleaning will not adversely influence "permanent" type-metal false walls. However, many firms make it a rule to avoid liquid cleaning any old fonts if at all possible.

To be done properly, liquid cleaning by hand can be quite time consuming if large quantities of mats are involved. Mats should never be dumped loosely into a container for cleaning, but should be carefully brushed with the solution and then thoroughly dried before returning to the magazine.

The majority of liquid mat cleaning is done in conjunction with mat cleaning machines which are discussed in the following section.

Matrix Cleaning Machines

Approximately one out of five firms is now using a matrix cleaning machine. Those who have tried machine cleaning but discontinued because of some dissatisfaction constitute a group of about 25%. Although other foreign and domestic machines have been introduced from time-to-time, the Rocla Matrix Cleaning Machine (available from Federico K. Hutzler) was the only such machine reported by Survey respondents.

The Rocla Matrix Cleaning Machine, manufactured in West Germany, has been around for at least 25 years. In operation, mats are fed into the machine individually from a stacker, and are then exposed to eight brushes – two for the sides, one for the teeth, one each for front and back, one for the bottom of the matrix and two small ones for the lugs. The matrices pass the brushes which are wet with a liquid cleaning compound, and then travel between two endless (felt) belts which dry off the surplus detergent.

Favorable comments among Rocla users ranged from "as good as can be expected" to "very good results." Other representative remarks included: "Fast and efficient . . . ," "Quite pleased with results . . . ," "3-4 fonts can now be cleaned in same time as one previously . . . ," etc.

The unfavorable comments, or sources of dissatisfaction, concerning Rocla included the following: "Performs as it should but washes away false wall . . . ," "Too hard on mats . . . ," "Fluid takes contrast off mats . . . ," "Chemicals rust steel parts of magazines . . . ," and one unexplained "not satisfactory." Generally, however, the favorable comments far outweighed the unfavorable ones among firms experienced with the Rocla machine. And, it should be noted that a significant percentage of the unsatisfactory experiences might have been more closely related to the use of an inappropriate cleaning agent rather than any limitation inherent in the mat cleaning machine itself. A few firms particularly stressed the advantage of obtaining the motorized machine rather than the original, hand-operated model.

A rather new and unique approach to matrix cleaning is the use of an ultrasonic cleaning device. Although only one firm reported its use at the time of the Survey, it is believed that interest in this machine – called a Sonomatic Ultrasonic Cleaning Machine (C. & E. Marshall Company) – or in others like it, will expand considerably. Another supplier recently interested in this application is Jetronic Industries, Inc.

Promoted as the "no hands" method of cleaning mats, the ultrasonic technique cleans mats through the use of sound waves above the range of human hearing. In operation, energy is transmitted to the detergent cleaning solution so as to cause the imploding of countless tiny "bubbles" which literally blast dirt and contaminants from the mats. However, despite the tremendous energy, the action is said to be so gentle that mats cannot be harmed. Interestingly, small and delicate watch parts are cleaned in approximately the same way. According to the present user, early experiences indicate that ultrasonic cleaning has not destroyed contrasting. And, although not wholly conclusive at this point,

it is reported that the "false wall" has not been adversely influenced.

Based upon the very successful experiences of one firm thus far, it seems likely that the use of ultrasonics in mat cleaning will continue to find increasing application. Your investigation of this method is strongly recommended.

Frequency of Matrix Cleaning

The frequency of matrix cleaning exhibits a very wide differential between plants. According to our present study, the cleaning range runs from monthly to *never*. Of the total: 48% of firms report cleaning "only when necessary;" 26% clean "occasionally;" 25% clean "periodically;" and, only one firm indicated "never" cleaning mats.

Of those reporting periodic cleaning, 46% do so annually, 32% semi-annually, 10% quarterly, and the remaining 12% indicate cleaning more frequently than every 3 months.

The frequency of matrix cleaning is primarily influenced by the degree of matrix usage. Fonts in daily use will of course require cleaning more often than certain job fonts that receive only occasional use. Other factors which hasten the arrival of cleaning time include the extent and nature of machine maintenance, the amount of handling to which mats are subjected, general operating cleanliness, and even such a seemingly unrelated factor as atmospheric humidity.

It should be noted that the careless use of oil on the back and front mold wipers can be a major cause of frequent mat cleaning. Incidentally, several firms have indicated very substantial reductions in mat cleaning through the judicious use of Simonize on the wipers.

Because of the large number of fonts in most plants, and the wide variance in font usage, a regular mat cleaning schedule is often difficult to maintain. Effort should, however, be made to clean at least the commonly used faces on a periodic basis. Providing it does not adversely extend the intervals between cleanings, mat maintenance is an ideal slack time activity.

The sometimes used argument that popular fonts are not cleaned because they are replaced too often, prompts one to wonder whether that is the very reason they are being replaced so frequently!

Ideas Concerning the "False Wall"

One of the perennial debates among knowledgeable users of linecasting mats concerns the value of the so-called "false wall" that often tends to develop on matrix sidewalls.

In answer to the question—"Have you found that *not* cleaning the "false wall" serves as additional protection against sidewall damage and the occurrence of hairlines?"—the affirmative responses considerably outnumbered the negative ones. In terms of percentage, 60% indicated yes, 32% indicated no, and the remaining 8% were uncertain or had found their experiences generally inconclusive.

Among those opposed to the false sidewall concept, the following quotes gleaned from Survey comments are representative:

(1) "Not cleaning sidewalls is generally regarded by most of the old school as a safeguard against hairlines. Our experiences indicate that the cleaner mats are kept from *any* foreign matter, the better and longer the mats will perform."

(2) "Build-up of metal, graphite, etc. on matrix sidewalls will only serve to assist in the breaking down of sidewalls."

(3) "Since we eliminated metal build-up and false walls through the use of Bandaid, our hairline problem has become insignificant."
(4) "We do not have a metal accumulation but we do encounter a combination of oil, graphite and dirt which tends to create hairlines and push the walls in by holding mats apart."
(5) "Once a false wall starts to develop, it will cause other mats in the font to start hairlining."
(6) "It is our belief that when mats have developed a true false wall, they are no longer serviceable."

On the other side of the ledger are those that believe—within varying degrees of certainty—that the false wall *does* serve a valuable, protective function. Representative comments from this majority group included the following:

(1) "Any accumulation that may adhere to the sidewall helps to keep metal from forcing itself between the damaged walls and showing up as hairlines."
(2) "Slight oxidation of the walls seems to help maintain walls if handled carefully."
(3) "False wall is particularly valuable on old fonts, and should not be disturbed."
(4) "Fonts cleaned with a strong solvent which removes the false wall seem to show more hairlines after they are cleaned."
(5) "The value of the false wall is an absolute proven fact!"
(6) "Any formation removed from the sidewall of a mat after it becomes hardened will leave an indentation the depth of the crust removed. This indentation then becomes the cause of the hairline."

In addition to those firms feeling strongly in one direction or the other, several firms gave qualified responses such as relating the value of "the wall" to the extent of build-up or indicating that sidewall destruction and hairlines were not necessarily synonymous.

It might be noted in passing, so-called "metal repellents" have found virtually no application as a means of preventing metal build-up on mats. Although a number of firms reported having unsatisfactorily experimented with such products, only one out of the 91 reporting firms is now occasionally using such a repellent. This firm indicates the use of No-Mel which they claim "creates a mud-like substance that helps develop false walls."

If any useful conclusion can be drawn, it is perhaps that false walls will develop at a rate that is inversely related to the care and cleanliness of the mats and spacebands. Although unquestionably better that a false wall *not* be permitted to develop, if it does happen then it should definitely be left undisturbed. It is generally agreed that removal of a false wall will create problems faster than neglecting the wall. However, no false wall is of course preferable to a neglected wall!

Perhaps the most logical explanation of how the false sidewall develops is that graphite from the spacebands combines with moisture and dust in the air and compresses into the sidewalls during casting, filling in any areas that have been scraped or scratched as the result of the impact from mats falling into the assembling elevator. This then serves as a temporary barrier to the entry of metal. When sidewall damage continues, however, from further pounding in the assembler, type metal begins to seep in and replace the compressed graphite to begin building the *false* sidewall. In time, a complete type metal sidewall is then built up.

In regard to hairlines generally, it will be shown later that the possible causes for hairlines are so many and varied that it becomes difficult to determine with certainty how significant a role the false wall does in fact play.

Cleaning Matrix Magazines

When magazines and/or matrices are new, it will usually be found necessary to brush the magazines quite often until all of the initial grit has been removed. Under ideal operating conditions, the continual circulation of the matrices in and out of the magazine should serve to polish and clean themselves unless an excessive amount of oil is used on the machine where it might come in contact with the matrices.

In practice, air-borne dust and other contaminants require that magazines be cleaned from time to time to insure smooth, uninterrupted action. It has been noted that only about ⅓ of firms clean magazines on a regular periodic basis. Those cleaning annually represent 17%, semi-annually 7%, and quarterly or less only 6% of the total.

The next largest grouping is the 29% who report cleaning magazines whenever mats are cleaned; 27% clean only when necessary; 11% indicate "occasional" cleaning; and 3% do so whenever mats are run out.

The standard methods of cleaning magazines were generally reported. There was, however, some variance in the extent and nature of solvents used. Those using dry brush and/or brush and solvent represented 63%, while 34% indicated the exclusive use of dry brushing. Compressed air was employed by 12% of the former and 30% of the latter group.

Although 15 different solvents were reportedly in use in conjunction with magazine cleaning, white (high-test) gasoline, carbon tetrachloride, and naphtha were the three most frequently indicated. As a general rule, it is well to remember that magazines should *not* be washed unless absolutely necessary. If oil contaminates the magazine, or other factors necessitate washing, alcohol is a safe, effective solvent. In any event, magazines should be thoroughly dry before mats are run back in.

In passing, it should be remembered that the transparent Visilite magazines can be adversely affected by certain solvents. Care should be exercised before using any solvent that is not specifically recommended by the manufacturer of these magazines.

Since a few firms reported using graphite as an adjunct to magazine cleaning, a related comment is necessary to emphasize the pitfalls of using graphite in magazines. Graphite may make matrices drop well for a short time, but in damp weather it is likely to cause gum to accumulate. Humid atmosphere causes graphite to form an oily caking in the channels which usually makes more frequent cleaning necessary. If magazines are properly maintained and regularly cleaned, the use of graphite on matrices or magazines should not be necessary.

Preventive Maintenance of Matrices

The importance of preventive maintenance of mats has already received emphasis, both explicitly and implicitly, in preceding sections. Despite the apparent mystery that surrounds the causes of various mat problems, it can be assumed that many of these difficulties could be measurably reduced – if not completely eliminated – through the conscientious application of preventive maintenance techniques.

It is noted that only one out of three firms indicated any specific program or routine by which they insured the proper maintenance of

mats. Although such programs need not be formally organized, it is essential that they involve systematic, periodic procedures. The following representative precautions, taken from Survey comments, include—but do not exhaust—the common considerations in preventive mat maintenance:

(1) "At the end of each working day, mats picked-up off the floor or from the pi stackers, copy bench, etc., are run into a magazine labeled *Miscellaneous.* This daily procedure puts characters in their proper channels, prevents any damaged mats from entering their respective magazines, and separates pi mats for easy storing."

(2) "Using a special report form, readers will mark all characters which have developed hairlines or other problems; then regular maintenance will either repair or discard them before they can damage the entire font."

(3) "Insist on the maintenance of rigid standards of inspection on machines, particularly the casting functions. Maintain constant vigil to quickly detect any machine misadjustments."

(4) "Pay particular attention to the inspection and maintenance of horizontal and vertical lock-ups, vise-jaws and assembling elevator. Avoid excessive lubrication of front and back mold wipers; keep distributor screws oil-free."

(5) "We insist that all dropped mats be turned over to the machinist for inspection and return to the magazine. Once stepped on, or mixed with metal, mats are quite likely to be damaged irreparably."

(6) "Insure the careful and frequent inspection and cleaning of both mats and spacebands."

(7) "Periodically check the accuracy and alignment of all transfer mechanisms on the machine to insure a maximum of smoothness and a minimum of friction to protect the combination teeth."

(8) "Do not tolerate loose lines, and insist that tight lines never be forced into the vise jaws."

(9) "Insist that the keyboard not be operated nor matrices handled with dirty or greasy hands. Hands and machines must be kept clean. *Greasy dirt is the worst enemy of matrices!*"

There are, of course, many other facets of preventive matrix maintenance beyond those more important ones reported above. However, perhaps the basic key to any successful maintenance program is a conscientious, curious and capable machinist, and a team of operators that fully appreciate the significance of properly maintaining the mats and machines they use. A little education in this latter regard can go a long way toward minimizing your mat problems.

MATRIX REPAIR

Linecasting Matrix Repair

The relatively high cost of mats, combined with the inability to always obtain immediate replacements, justifies certain types of matrix repair. Under any given circumstance, the nature and extent of the damage should determine when it is practical to attempt repair and restoration of mats to useful service.

Among Survey respondents, it was noted that 35% always repair, or attempt to repair their damaged mats; 34% do so occasionally; 22%

indicate frequently; and, only 9% of firms report *never* repairing linecasting mats. This latter group of firms expressed the general feeling that mat repair is "false economy . . . too time consuming . . . inappropriate in terms of quality requirements . . . etc."

Considering the remaining 91% of firms that engage in repair to some extent, by far the most practiced matrix repair involves minor straightening of lugs and slightly bent mats. The following comments are representative of existing attitudes regarding mat repair:

(1) "The extent of damage, time and effort required to make a repair, and the accuracy of the resultant repair should always determine the practicality of such activity."

(2) "Whenever a mat can justifiably be repaired, it should be accomplished only by a qualified machinist. Operators should *never* be permitted to attempt mat repair."

(3) "Mats that have started to hairline should always be discarded. And, never spend an unrealistic amount of time repairing an individual mat."

(4) "Providing inaccuracy is minor, we reshape bent mats, redefine combinations, remove burrs, and straighten bent lugs. Mats with sharp bends and smashed toes are *always* discarded."

(5) "Teeth and lugs are the only repairable mat defects. We have found that when a mat is bent it can never be returned to perfect straightness again."

(6) "On thin mats we only attempt lug straightening. Other repairs can be made to thicker mats (14 point and above) because of their strength."

(7) "After any repair, mats must be thoroughly checked to insure their accuracy. Such verification should involve running into a magazine, casting, and then proofing to inspect for hairlines and misalignment."

Obviously, there exists considerable variance in the scope and degree to which firms practice matrix repair. To a large extent, the skill of the person that does such repair will determine what is practical. As a general rule, it is wise never to repair seriously damaged mats, nor to use mats whose accuracy is questionable. And, the labor cost of repair must always be directly related to the cost of the replacement mats. Emergency requirements may, of course, necessitate repairs that would normally be considered impractical or uneconomical.

Repairing Matrix Lugs

Having discussed the matter of matrix repair in a rather general manner, we shall now consider the more common aspects of such repair and the tools and technique by which they are being accomplished. Lugs are perhaps the most frequently maintained mat part, and shall be considered first.

According to our present data, 3 out of 4 firms repair lugs. Of these firms, more than half do so through the use of Align-A-Mat (Fisk Industries); 22% use parallel jaw pliers (duck bill, needle nose, etc.) with or without a mat file; 17% use the Matrix Repair Tool (Star Parts); and 7% use a hammer (generally brass) in conjunction with a precision anvil.

Considering the Align-A-Mat, 80% of its users indicated satisfactory experiences. Representative comments among those indicating anything less than complete satisfaction included the following: "Only temporary salvage for a short period, mats soon out of line again; needs extreme

care when repairing thin mats; slow, not accurate enough for job work, O.K. for book work; helpful but not 100%." These minority observations should not, however, detract from the general utility of the Align-A-Mat.

In addition to assisting in the repair of individual matrix lugs, these devices can be quite useful in the restoration of complete fonts, when sorting up with replacement mats. The older mats in the magazines can be brought up to the same alignment as the new ones, thus eliminating one of the most troublesome causes of misalignment.

Before leaving the matter of lug repair, a word might be said about matrix file gauges used to remove "burrs" from lugs. Nearly 75% use either the Matrix File Gauge (Mergenthaler) or the Matrix Ear Filing Tool (Star Parts), with about equal frequency. The matrix file tool (Wm. Reid) is used by 10%; 7% use homemade devices; and 5% report using the Matrix Ear Filing Tool (Intertype). The remaining firms report the use of a hammer to peen-out burrs, their contention being that the filing of matrix metal should be kept to an absolute minimum.

Straightening Bent Matrices

With the exception of approximately 5%, all firms attempt to repair mats with some varying degree of frequency. Although severe, sharp bends rarely justify repair, a great many mats become slightly bent and can be quickly returned to useful service through careful straightening.

The manner in which repair is accomplished varies to some extent between firms. About two-thirds, however, indicate the use of pliers, such as "duck bill" or other long nose, parallel jaw pliers. The next largest group reports the use of hammering techniques, which normally involve light tapping on a precision, flat anvil or hardwood block. Hammers in use included rawhide, brass, copper, plastic, or other relatively soft impact materials that are less likely to cause damage. In any event, such hammering must be done with extreme care so as not to distort the mat or damage the sidewall.

Beyond the actual repair, there is always the extremely important necessity of gauging the success of the repair. The two most commonly employed techniques for such verification are: the use of a highly accurate, flat steel surface to test for any "rocking" that may indicate the mat is not perfectly square; and, used with almost as much frequency, is the placement of the repaired mat between two rather thick, new or like-new mats. In this latter test, any light passage between the mats would indicate an unsuccessful repair.

Other methods of checking straightness which are often used in conjunction with the above involve: checking squareness on an accurate file gauge; verification based on ease of movement through magazine, and other actual use tests; use of such verification gauges as Align-A-Mat and the Star Repair Tool; and, finally, the trusty "eyeball" conditioned by years of experience.

Maintaining Matrix Teeth

Matrices should travel from one position to another very precisely, smoothly and without wear. Essential to the life of matrix teeth is the maintenance of perfect alignment at the three transfer points, i.e., from the first elevator jaw to the second elevator bar, from the second elevator bar to the distributor box bar, and, finally, from the distributor box rails to the distributor bar. Periodic attention to the alignment adjust-

ment at these points can save a font that might have otherwise been ruined because of badly burred or damaged teeth.

Apart from damage to an entire font, more often individual mats will experience some minor difficulty which makes it desirable to verify the opening between the combination teeth or, in some cases, to attempt limited maintenance of the teeth. From the Survey, it is noted that 40% of firms indicate the use of some appropriate gauge to check wear on matrix teeth and verify the distance between the teeth. An even smaller percentage, however, ever attempts to repair such defects as may be found. It must be conceded that only the most minor teeth defects can be effectively remedied.

The common repairs in conjunction with combination teeth are normally accomplished by using such tools as small 3-cornered files, matrix swaging tools, peening (usually with rawhide mallet or brass hammer), and squeezing of the combination teeth using a pliers or vise.

It should be noted that all matrix repair—and particularly in relation to teeth—is much less a matter of tools or devices than it is the skill and judgment of the individual attempting to accomplish such repair, or deciding the practicality of repair under any given circumstance.

MATRIX CONTRASTING

Matrix Contrasting Applications

For the past 15 years or so, matrix contrasting has continued to experience refinements and expanded application. We now find the contrasting of matrices very widely accepted as a significant aid to production.

It is interesting to note that 90% of participating firms reported using matrix contrasting to some varying extent. More specifically, 55% indicated *all* of their mats were contrasted; 19% said *most;* 14% said *some;* and only 10% had *none* of their mats contrasted.

When asked the question – "If all of your mats are *not* contrasted, do you contemplate doing so?"—nearly half of the respondents noted their intention to eventually contrast all their mats. Suffice to say, the increasingly large number of firms who continue to contrast mats provides practical evidence of the merits of contrasting.

In the case of Ludlow mats, however, the situation is essentially reversed. Of the 65% of Survey firms that reported having Ludlow machines, only 11% indicated the application of contrast to Ludlow mats. And, in most cases, the contrasting was done only in sizes below 18 point.

Generally, it was felt that the necessity of contrasting Ludlow mats was of nowhere near the same magnitude as in the case of linecasting mats. However, because of the necessity to continually handle Ludlow mats it is essential that they be kept clean by never handling with greasy or otherwise contaminated fingers.

Basic Methods of Contrasting Matrices

As matrix contrasting continued to gain acceptance over the years, the number of available methods and techniques expanded accordingly. Presently, these range from very simple do-it-yourself kits to the application of contrasting on a contractual basis by specialists in matrix contrasting.

Since there now exist approximately 8 or more avenues to contrasting, it has become more difficult for the uninitiated firm to isolate the

best method or procedure. Such factors as plant size, number of fonts to be contrasted, caliber and availability of plant personnel, color coding requirements, etc., will normally indicate the best alternative. These include: Service contract; outside persons only when called; mailing or otherwise sending mats to be contrasted as required; and, finally, do-it-yourself kits—of which there are quite a few.

For those plants where maintenance personnel are available, the in-plant methods—if followed exactly according to instructions—may offer a greater degree of control and flexibility. Where a considerable number of fonts are in use, the initial job of contrasting all mats can be quite a chore, but once finished the upkeep is relatively easy and economical. It can, and often does, also provide an ideal opportunity to do the usually necessary job of coding and cataloging the various pi mats and sorts that have accumulated.

On the other hand, many firms have found the convenience and generally good service of contrasting specialists quite practical. Such companies will perform the service on a contract basis or an individual order basis. Outside service can be performed within or without the plant and is usually estimated in terms of *inches* of mats contrasted.

Statistically, the Survey reveals that 49% of firms—of varying size—use in-plant personnel in conjunction with do-it-yourself techniques. Nearly one-third report using the service contract approach; 14% use outside persons called only when needed and paid per visit; and, 7% mail or otherwise send off mats to be contrasted. Under certain conditions, a number of firms indicate using more than one approach. For example, a firm may normally use a contrast service, and yet maintain an in-plant kit for rush requirements.

Contrasting Systems and Experiences

All systems and services considered, Matrix Contrast Corporation is now providing contrasting services to approximately one-third of those firms reporting the use of contrasted mats. The announcement, in early 1962, that both Mergenthaler and Intertype would actively promote Matrix Contrast sales has no doubt added substantially to the number of users of this service.

Users of Matrix Contrast Service are generally well satisfied. The many favorable comments ranged from satisfactory to very excellent. Others indicated "reliable . . . fast over-night service . . . good method . . . contrast lasts fairly long, etc." Among those who had at one time used this service, or in a limited number of cases are still using it, the following unfavorable comments were representative—"expensive . . . billing methods confusing . . . too much wear put on mats by buffing . . . service not consistently good."

In all of the reported experience evaluations it should be remembered that the variance in requirements, expectations, and demands from one firm to another will influence their judgment as to the merits or demerits of any particular contrasting technique or service. The significance of the experience comments should therefore be influenced accordingly.

The only other contrasting service with any significant percentage of users was New England Lino-Matrix Service with 14% of the total. New England is currently serving firms in Connecticut, Maryland, Massachusetts, New Hampshire, New York, Rhode Island and Vermont. Experiences of present users were completely favorable.

Turning to the do-it-yourself kits, which represented approximately

half of the total, Ebonite Blackface Process was most frequently reported. Following closely behind was Dri-Stain Process with 13%. Magic Matrix Black (Bayport Chemical) and Mat-Blak (Superior Linotype) received 8% and 3% of the total, respectively.

Among present and past users of each of these four in-plant systems, the favorable comments exceeded the unfavorable comments or limitations expressed. To the limited extent it may be of interest and value, we shall note some of these comments for each system.

Ebonite favorable: "Does good job . . . has black, even contrast . . . company very helpful and cooperative . . . contrasting stands up very well . . . we save a nice sum, etc."

Ebonite unfavorable: "Has objectionable odor . . . time consuming and messy."

Dri-Stain favorable: "Successful . . . have used very satisfactorily for over 10 years . . . good contrast obtained . . . holds up well . . . good service and cooperation from supplier, etc."

Dri-Stain unfavorable: "Has uneven black . . . very hard to color with their paints . . . service at times poor."

Magic Matrix Black favorable: "Easy to do . . . very good . . . inexpensive, etc."

Magic Matrix Black unfavorable: "Too tedious . . . contrasting results and colors poor . . . does not hold up well."

The comments of the three firms using *Mat-Black* were generally satisfactory.

It should be promptly noted that many of the unfavorable comments associated with the above kit systems are based to some significant extent on improperly followed or disregarded instructions. There is strong reason to believe that all of the above do-it-yourself methods will give acceptable results providing the process is used correctly, i.e., precise adherence to manufacturers' directions — *no short-cuts!*

In addition to several contrast suppliers reported by only one firm each, we have a group constituting 8% of the total who report using "our own system or formula." The materials reportedly being used by these firms include such seemingly unrelated products as fingernail polish, shoe polish, as well as various artist and poster paints. Other firms have developed somewhat sophisticated chemical formulations and techniques that apparently have worked quite well for them.

Although a few firms may have developed effective homemade systems, it is normally more efficient and convenient to choose from the variety of standard contrasting systems and services that are available.

Contrasting Cost and Time Requirements

The Survey has revealed that the advantage or disadvantage of one contrasting approach over another is not significantly related to cost. Other factors such as convenience, speed, use of fixed cost labor, etc. seem to play a more significant role.

Perhaps surprisingly, it is noted that nearly one half of the firms using do-it-yourself systems report contrasting costs i.e., materials and labor, which are no less expensive than would be incurred using outside sources, with or without a service contract. It must be remembered however, that the do-it-yourself labor cost is normally incurred during slack or otherwise nonproductive periods.

Exclusive of the particular methods employed, it was determined that the most commonly reported cost figure was $12.00 to contrast 1500

mats. Broken down further, we find that 55% indicated $12-15.00 per font (average 1300 mats); 28% submitted costs of less than $12.00, and 17% were in excess of $15.00. Since not all of the do-it-yourselfers specifically indicated whether their reported cost included labor as well as materials, it seems likely that if all reported both costs, the 28% figure would rise to some extent.

Without exception, all firms under some type of contrasting service contract fell within the $12-$15.00 per font cost range. Among the in-plant methods, 48% were less than $12.00, 23% were $12-15.00, and 29% were *over* $15.00.

Considering the common per inch basis for determining contrast cost, the most frequently reported figure was $0.15 per inch. All methods considered, 70% of firms reported per inch costs of from $0.15 to $0.17. Among the do-it-yourself group, when materials only were considered, the costs ranged from $0.02 to $0.06 per inch; with labor costs added, the per inch rate ran to as high as $0.20. Considering firms under a service contract, 60% reported $0.15 and 40% reported a per inch contrast cost of $0.17.

The length of time required to properly contrast a font of mats will be determined by such factors as who does the contrasting, where it is done, the condition of the mats, and the degree to which supplementary work, such as magazine cleaning, mat inspection, etc., is accomplished at the time of contrasting.

Realizing the extreme importance of rapid service, companies specializing in contrasting have generally provided this fast service. Where mats were leaving the plant to be contrasted, virtually all firms reported either overnight, 24-hour or weekend service.

Considering in-plant contrasting, two hours per font was the most frequently reported time allowance. Times from 2-3 hours accounted for approximately 50% of all times reported. The extremes ranged from 1 to 4 hours per font, with about equal representation above and below the average. It can be assumed that some of the longer times reflect such additional efforts as magazine cleaning, mat checking, etc. In addition, the degree of care and precision exercised in contrasting will also influence the time consumed. It should also be noted that quite a few firms admittedly did not know with any accuracy how long was being spent in contrasting fonts, nor how much their contrasting was costing them.

Color Coding and Linescribing Matrices

When first introduced, and for some time thereafter, the bulk of all matrix contrasting was confined to white reference characters on a black background. Today, however, we find the situation has essentially been reversed. Only about 5% of firms reported limiting their contrasting to white on black. The remainder use colors, in some varying degree, to extend the utility of the contrasting to serve a variety of identification and classification functions. Regardless of the color used in the reference character, the black background on the reference edge remains the same.

Statistically, the average firm is using 5 colors in conjunction with their contrasting. Although a range of from 2 to 10 colors was reported, the use of from 4 to 7 colors accounts for 85% of the total. While the number of available colors will differ from one method or system to another, the most popular avenues to contrasting provide either 4, 5 or 6 colors. The relatively small number of available colors is often considered a limitation. It should also be remembered that as more colors are added it becomes increasingly difficult to remember and rapidly dis-

tinguish the differences between colors and their individual meanings.

Of those firms engaged in matrix contrasting, approximately 75% have developed a color coding and/or linescribing "system." Considering this group, only one out of three reported the use of linescribing in conjunction with their contrast system. Between firms, there is little unanimity in the specific organization of the various systems used. Color coding is generally used either to identify family or series affiliation, or to distinguish between point sizes. Linescribing was most often reported used for point size identification.

As indicated, the applications for color contrast vary considerably from firm to firm. Since plant sizes, conditions, etc., also vary, it is understandable that one system could not provide the best solution to all plants. To the extent it helps in developing the system best suited to *your* requirements, the following applications are presented as being representative of those reported:

(1) Using one color to denote each family, i.e., all the sizes and styles of the same basic design. For example, making all of the Bodoni family red on black. (Color duplication will be necessary, but should be duplicated on *dissimilar* faces.)

(2) Using a separate color for each series, i.e., the complete collection of all sizes of one style and design of type. For example, Century Schoolbook in all sizes might be green.

(3) Using different colors to identify various weights and styles, i.e., light, medium, bold, regular, expanded, condensed, etc. For example, all bold face fonts, regardless of family or series, might be colored yellow.

(4) Colors used according to point size, usually from 6 to 14 point depending on the number of available colors. For example, all 10 point mats might be referenced in white.

(5) Color coding to designate and identify mats that have been bridge notched for mixer work. While all non-cut mats are referenced in white, notched mats might be colored differently for each size of a particular series. Cross-check other fonts that might be used on mixers together to keep to a minimum having two fonts with the same color scheme.

(6) Other firms use white for all standard references, and colors are used to distinguish between various types of leaders, to identify short and long descenders, old style figures, special accents, to categorize various types of pi mats, etc.

Although there are several other minor applications for matrix color coding, the above should prove most useful in developing or refining your own system. If a particular color scheme arrangement has not proved practical, it can easily be changed when recontrasting becomes necessary or before, if possible. Regardless of the specific approach, to be effective a color coding system must be simple, easily understood by all, and should accomplish the task for which it was designed.

Although less widely practiced than color coding, linescribing can tremendously expand the identification and categorization functions of contrast coding. Whereas the practical number of available colors is rather limited, linescribing above the reference letters can provide a relatively large number of different identification markings. For example, the use of 3 standard lines permits 8 combinations; when 5 lines are used, the number of possible identifying combinations jumps to 29. And, if – as several firms reported – the scribed lines are further dis-

tinguished by color coding, it becomes readily apparent that a great deal of coding flexibility is available.

According to Survey responses, the most common linescribing application is for point size identification. Other representative applications included: Use of scribed lines to identify accents, long and short descenders, and other pi or alternate mats that run-in; to categorize fonts cut for mixer use; to indicate different sizes of Lining Gothic fonts when 3 sizes are used in one magazine, etc.

In addition to the use of standard scribing services and devices, a number of firms have made their own devices. One firm, for example, reports having designed and built a simple but accurate scribing machine to cut 5 or less .014" lines just above the reference mark. It should also be noted that some firms report using a scribed line *under* the reference character — visible only when mats are in the duplex position — to indicate boldface, for example, when roman w/italic and roman w/bold in the same family are similarly contrasted.

Suffice to say that with a little thought and planning, the combination of matrix contrast color coding and linescribing can be very effectively employed for purposes of identifying and controlling a great quantity and variety of linecasting mats.

Effective Life of Matrix Contrast

The longevity of matrix contrasting is largely a function of usage. The greater the use frequency, the more often mats require recontrasting. Apart from use, however, there are several other significant factors that can directly influence the effective life of matrix contrasting.

The most influential of these other variables include: (1) The degree to which the mats were properly contrasted originally; (2) the particular contrasting method or system used; (3) the nature of the colors used; and (4) the method and frequency of mat cleaning. Any or all of these factors can significantly influence matrix contrast life. In the matter of mat cleaning, it is wise to insure in advance that cleaning agent and/or cleaning machine will not destroy or otherwise adversely influence the effectiveness of your mat contrast.

Based upon responses to a related question, we find a rather wide variance in the length of time contrasting was claimed to remain effective. In the case of text, or other very frequently used fonts, we note a reported range from 6 months to in excess of two years. On the other hand, job fonts, or other fonts not in constant daily use, exhibit a range that runs from 12 months to more than 5 years in a few cases.

More specifically, it is noted that popular fonts are recontrasted every 12 months or less by approximately two-thirds of firms, with about one-third doing so every 6 months. And, only 6% extend the interval between contrastings of these mats to more than two years. In the case of less used job fonts, two-thirds indicate recontrasting every 2½ years or less, with about one-third doing so every 6 months. Only 17% allow more than 3 years to elapse between recontrasting of job fonts.

Apart from the previously mentioned factors which influence the longevity of matrix contrasting, it should be realized that widely varying interpretations as to when recontrasting becomes necessary will also serve to explain the variations in elapsed times between firms. A few firms reported that, in some cases, fonts in constant use require replacement before the need for recontrasting arises.

Advantages of Matrix Contrasting

There is no doubt that contrasted mats offer a number of very practical advantages. This is evidenced by the fact that only 3% of the total Survey respondents indicated that they had *not* found contrasting to be of significant value. Although the extent of benefits reported differed somewhat between firms, it was generally agreed that contrasting is an investment that pays dividends in increased operator efficiency.

Questioned as to the most significant advantages of mat contrasting, improved accuracy, i.e., less errors, was rated number one; reduced operator fatigue or eye-strain followed closely behind; and, increased setting speed was considered a factor of somewhat lesser consequence. The integral relationship and dependency of each of these advantages is readily apparent. Beyond the more common benefits, those firms who have developed methodical color coding and linescribing systems in conjunction with their contrasting are afforded still other notable advantages.

Although the percentages of savings reported were in most cases educated "guesstimates," they are still meaningful. Within a range of from 0% to 90%, the arithmetic average reduction in error rate was reported to be 30%. Interestingly, this figure lends some added credence to the long-standing claim of ⅓ savings in error rate normally made by contrasting supply firms. When the high and low extreme figures were not considered, we found that approximately one-half of all firms using contrasted mats reported error rate reductions ranging between 5% and 24%.

The kinds of errors that contrasting serves to reduce are wrong fonts, double letters, transpositions, wrong letters, missing letters, etc. In the case of wrong fonts, however, it is essential that color coding and/or linescribing be employed to enable such matrices to be easily spotted in the assembler and quickly removed to avoid the necessity of having to reset wrong lines.

Regarding the matter of reduced operator fatigue, the highly increased visibility and legibility of contrasted reference marks enables the operator to scan the assembler with speed, accuracy and less fatigue caused by eye-strain. It is generally conceded that operators much prefer working with contrasted mats, and this no doubt provides some intangible morale or job satisfaction advantages. And, by increasing the number of corrections made before lines are cast, you usually save not only machine and operator time, but also the time of proofreaders, floormen and others.

A short sampling of interesting and representative comments from the Survey concerning the advantages of matrix contrasting include the following:

(1) "Greatest advantage and error reduction is in setting correction and alteration lines. Has served to make revise proof corrections almost negligible."

(2) "Value of contrasting is to some extent dependent on the nature of composition and the particular operator in question. Certain operators are, for example, more efficient when not attempting any assembler reading on regular composition."

(3) "Most apparent advantages of contrasting are in detecting wrong fonts and in conjunction with mixer operations."

(4) "Eliminates objectionable brass glare in the assembler, and also eliminates the necessity of continually cleaning the reference side of mats to maintain readability of the matrix markings."

(5) "Never made a comparison test to determine savings, but we get lots of operator complaints when a font is put into service prior to contrasting."

Those who have not yet considered contrasting, or who have only partially contrasted their fonts, should certainly reconsider based on the obvious merits of contrasting, particularly when done in conjunction with systematic color coding and linescribing. It should also be emphasized that while contrasting can serve to make a good operator even better, it is not likely to make a clean operator out of a dirty one!

MATRIX QUALITY ASSURANCES

Quality Checking New Matrices

The relatively high cost of mats, combined with the troubles that can result from defective or otherwise incorrect mats, justifies the time it takes to *properly* check each new font, or sorts, according to a predetermined, methodical system. Although there was a wide variance in the *degree* of "quality checking," nearly 85% of firms reported some routine procedure for checking new mats *before* they are put into actual production.

Considering all of the precautions reported, a really thorough checking of new matrices might include each of the following procedures:

(1) As soon as mats are received, check quantity and contents against original order. Check such physical identifications as font numbers, notches, face lines, reference marks, etc.

(2) Examine *mats* under magnification to detect damaged sidewalls, or other defects that would influence mat performance.

(3) Thoroughly clean mats in a suitable, oil-free solvent. Also insure that the magazine mats are to run in is also free of any foreign matter.

(4) Run mats through the machine, carefully checking for any defects that interfere with the normally smooth matrix cycle. Pay particular attention to the performance and accuracy of the combination teeth to insure that all matrices are being returned to their proper channels.

(5) Cast all mats *twice,* once in the regular and once in the duplex position, i.e., off and on the rail.

(6) Font proof all mats and have them checked under magnification by the repro department as well as the proofroom. Proofing on a coated stock makes face quality, hairline, and alignment defects more readily apparent.

(7) Repro proof again with very light impression to check the depth-of-drive, i.e., depth of the recessed character in the matrix. Any characters that do not print properly because of inaccurate drive should be immediately rejected.

(8) Proof with another, older font to verify that alignment is standard. And, in addition to font proofing by groups of characters, set about a dozen lines of copy to be added to the proof. Proofing all of the same characters of a new font together will not so readily reveal alignment defects as will an actual typesetting proof.

(9) In the case of replacement mats or additional sorts, cast and proof to check for face color, drive, and alignment with older mats in the same font.

In practice, the pressures of production and the matter of economics will largely determine how many of the above precautionary steps can be taken. Ideally, all should be done. In any event, all new fonts should at least be cast and proofed for checking before they are put into use. Defective mats or other discrepancies should be re-ordered immediately. The major matrix suppliers are normally quite cooperative in making such adjustments, so never keep any mats that are doubtful, inaccurate or otherwise useless.

Apart from the matrix checking procedure already mentioned, premature damage to new matrices can be prevented, and their correct performance aided, by first insuring that those machine mechanisms which can affect matrix life are properly adjusted and maintained. It should be remembered that worn conditions in the machine are more likely to cause trouble with new matrices than with older mats that have gradually "adjusted" to imperfect conditions. Finally, the importance of clean and accurate spacebands, in relation to obtaining maximum longevity from new mats, cannot be emphasized too strongly.

Font Proofing to Isolate Defects

In addition to the font proofing previously discussed in conjunction with verifying the accuracy of new mats, it is well to periodically cast and proof the complete contents of each magazine in the plant. Apart from the internal advantages, this practice better enables you to isolate and remove defects *before* they are noted by the customer.

According to the Survey, 62% of firms reported font proofing within some, widely varying, degree of frequency. About one-third did so on a regular periodic basis that ranged from daily on steady running fonts to annually or biannually. Font proofing semi-annually was most commonly reported. The largest individual grouping consisted of those firms who only proof when a font becomes suspect or when first signs of defective mats are noted either by repro operators, proofreaders, and, regrettably, in too many cases by the customer.

A significant number of firms reported always font proofing before, and sometimes during, any complex or large jobs such as books. Others indicated proofing "as often as possible," whenever sorts were added, or whenever magazines and/or mats were cleaned. Ideally, methodical font proofing on a periodic basis should be an integral part of every effective matrix maintenance program.

Preventive font proofing should be done as often as font use requires. The actual proof should be organized by like characters assembled in groups of five to facilitate inspection, counting, and, when necessary, removal of bad mats. It is also practical to include 15 or 20 lines of typesetting on the proof. This will, for example, make alignment defects more easily spotted. When the font proof has been thoroughly examined under magnification, defective or damaged mats should be immediately removed from the font and arrangements made for their replacement.

Bad mats in a magazine are somewhat like bad apples in a barrel, a few bad ones can in time contaminate the entire lot. Careful, periodic "font physicals" can go a long way in keeping your mats healthy.

Accuracy Verification Devices

Surprisingly, only one out of four firms reports the periodic or occasional use of one or more measuring devices to check or verify mat accuracy. There are a number of practical tools which can be effectively used to supplement font proofing as a means of detecting defective mats.

By far the most commonly used instrument, the micrometer is particularly valuable in measuring the lugs, i.e., ears and toes, of mats whose performance – mainly in terms of alignment – is questionable. The simplicity and accuracy of a micrometer can be employed in numerous other aspects of matrix verification. For example, it can be useful in determining the width in thousandths of various matrix quads, thin spaces, leaders, etc.

Unquestionably, depth-of-drive verification is another application for a related measuring device. The variance in the height of individual characters within a line is most often the result of improper drive in the mat originally. Matrix wear and certain machine factors can also result in character drive difficulties. At any rate, there are many times when it would be extremely helpful to be able to check the character drive on individual mats. One of the best depth gauges for this purpose is made by the Federal Products Corporation. At a cost of about $45.00, this simple device provides accurate readings of depth-of-drive to within 0.0005".

Magnification provides still another useful aid in checking matrix condition. Although only a minority of firms use any magnifying device, the following sampling of user comments indicate some of the advantages:

(1) "We examine sidewalls occasionally under magnification to see how much wear certain fonts are getting on various machines."

(2) "A 12-power magnifying glass is one of the most revealing methods we have found for finding flaws in mats and character casts."

(3) "When we note a character starting to hairline, we check that entire channel of mats under magnification. Also, when a mat is hairlining only occasionally on proofs, we use magnification to isolate by checking sidewalls."

(4) "We use microscopes up to 40-power to check damaged mats, hairlines, etc. Causes of mat problems are also more readily determined this way."

(5) "Font characters that tend to hairline most readily are periodically inspected under magnification to detect wear that may soon cause hairlines. In this way, we often prevent damage to an entire font."

(6) "Magnification is very useful when trying to decide whether to replace all or part of a font."

In addition to those specific devices already mentioned, there are a number of accurate, multi-purpose gauges that have been designed both to repair and to verify the accuracy of various mat parts and tolerances. Representative of these are the Align-A-Mat (Fisk Industries) and the Matrix Repair Tool (Star Parts). These gauges, as well as a number of others, will, for example, permit accurate checking of matrix teeth and the critical distance between the combinations.

In passing, mention might be made of a device called Matri-Check (Quality Control Corporation) which was announced a number of years ago. In essence, this unit was said to automatically inspect, by electromechanical means, linecasting matrices, rejecting those which were worn or sheared and did not align accurately. Inspecting at a rate of 40-50 mats per minute, it was claimed to accurately inspect an entire font in less than 30 minutes. Recent investigation reveals the only machine available to be in successful operation at the *New York Times*. It

appears that financial problems have restricted its further production and distribution.

Although time and cost considerations will no doubt preclude examining all mats for purposes of routine verification, there is no question that on many occasions the use of measuring or testing devices to verify mat accuracy or isolate defects is both practical and highly desirable.

Related Machine Maintenance and Adjustment

As many firms will sadly testify, the amount of service secured from matrices depends in very large measure upon the adjustment and general maintenance of the linecasting machine. Mats are extremely sensitive to, and readily affected by, the mechanical condition of the machine in which they circulate.

In their travel through the machine, matrices come in contact with most of the major operating mechanisms. If a mechanism is improperly adjusted or maintained, the condition will soon be manifest on some part of the matrices. For this reason, the importance of regular maintenance and adjustment by a capable, conscientious machinist is *extremely* important.

In responding to the question—"To what extent do you find that too infrequent or inaccurate checking or operation of essential machine mechanisms and tolerances has resulted in mat damage that could have been prevented through proper maintenance?" – it is of interest to note that only 5% of firms were able to answer *never;* 14% indicated *often;* 31% indicated *occasionally;* and, the remaining 50% reported that only *rarely* did improper or infrequent maintenance cause mat damage. Obviously, a great many mats continue to be needlessly damaged and discarded.

The most essential machine mechanisms concerned in the preservation of mats include: those connected with assembling; those associated with the first elevator; vise jaws; molds and mold wipers; vise closing and justification mechanisms; transfer mechanisms; the second elevator; distributor box mechanisms and distributor screws; magazines; spacebands, etc. While only a sampling of the related mechanisms, it is particularly important that these parts receive proper adjustment and maintenance if you are to obtain maximum service from your matrices.

While it would take a *book* of instructions to fully define and describe all of the related maintenance and adjustments, the following sampling of pertinent Survey comments should be of interest and practical value:

(1) "Accurate operation, adjustment and cleanliness of quadders and jaws should be verified on each shift, and more frequently if suspect. The squareness of vise jaws is extremely important. Faulty quadder operation can quickly ruin mats."

(2) "Insure that justification procedure is operating smoothly. Keep matrices at right tension in jaw for proper justification. We ruined two fonts in 2 days as a result of improper justification."

(3) "Replacement of second elevator and distributor box bars and points, when required, as well as checking for proper alignment at transfer points, and proper lift at the distributor box, will go far in preserving and extending the useful life of matrices."

(4) "Distributor screws should be frequently inspected to detect wear. Worn distributor screws can quickly cause a great many bent matrix lugs."

(5) "Maintain proper adjustment and condition of mold wipers. Insure that the wipers are keeping the molds clean. Molds and jaws

must be checked frequently to make sure they are being kept free of metal."

(6) "Many mats can be damaged at the points of transfer, lock-up and matrix lift in just a few hours if the parts are not adjusted carefully and checked periodically."

(7) "Make sure squirts are cleaned only by the machinist or other individual who can do so without unnecessary damage to matrices and bands."

There are, of course, many other specific considerations in maintenance to minimize mat damage. This sampling should serve to emphasize that constant surveillance by a qualified machinist is essential. Since machine adjustments and tolerances are often improved upon by the manufacturers, it becomes important that machinists remain continually aware of such refinements. And, for a preventive maintenance program to be fully effective, it becomes essential that operators *immediately* report mat damage, or any abnormal happening that could possibly affect any machine adjustment. The careless, unconcerned operator can easily undermine the very best maintenance efforts.

Matrix Manufacturing Tolerances

When asked the question—"Do your experiences indicate that matrix manufacturing tolerances should be further tightened?" – three out of five Survey respondents answered in the affirmative.

It should be noted, however, that a significant percentage of these firms had taken exception not so much to the established tolerances, but rather to what they considered excessive laxity in the consistent adherence to the standards. It was also felt that mats should be more thoroughly and carefully inspected by the manufacturer before being released for delivery to the customer.

By far the most frequent tolerance objection concerned depth of character drive in new mats. This matter was apparently a source of continuing discontent for a great many firms. Several expressed the feeling that present demands for repro perfection can hardly endure the depth-of-drive variations that sometimes amount to from 0.003″ to 0.004″. While slight differences in drive between old and new mats can sometimes be attributed to wear or certain machine factors, differences between new mats can only be explained by inaccuracies in manufacturing or inspection.

From an impartial consideration of quality control in manufacturing generally, it must be remembered that further tightening of manufacturing tolerances and inspection standards to reduce the percentage of defects can measurably influence the cost of a product. So, in a practical sense, we must equate the further tightening of plus or minus tolerances and/or inspection procedures to the possibility of increasing the cost of the product. Two related Survey comments indicated that: "If further tightening of matrix quality standards means higher prices, we would say quality is OK;" and, "If mat tolerances were any closer, their cost would be prohibitive."

However, within the framework of an acceptable quality/cost ratio, there are no doubt measures that can be taken by matrix manufacturers to reduce the present discontent. In the case of depth-of-drive, for example, it would seem reasonable to pursue the possibility of receiving a *proof* along with all new matrices. This would certainly make it easier for the manufacturer to detect and replace any mats whose drive was inaccurate or were otherwise going to be rejected by the customer.

This possibility, as well as others, will be pursued with the major manufacturers.

Beyond the matter of drive, there were several other sources of discontent that were commonly reported. Although not all of the following comments are universally considered valid, they nevertheless provide a sampling of opinions and reactions to current matrix manufacturing standards:

(1) "We feel sidewalls are now at their maximum thinness. On replacing certain mats, we found that the manufacturer had reduced the thickness of characters as compared to the *clean,* old font. Provide stronger sidewalls by improving the quality of the metal used."

(2) "Room for improvement in the alignment affecting parts. Lug variation in new mats often causes vertical alignment problems."

(3) "It is our feeling that more attention should be paid to the milling of mats. We have found many new mats will give four different micrometer readings when measured on each corner."

(4) "Reference punching depth is quite variable, making contrasting and subsequent readability poor. And, too often new mats have rounded edges on the reference side, making contrasting of this edge more difficult."

(5) "The manufacturing accuracy of mats should be improved to meet the increasingly high standards demanded from hot-metal. Manufacturers' awareness of this changing use of matrix products from largely printing from metal to repro proofs is most important."

(6) "Tolerances are OK, but quality assurances during manufacture and inspection are too lax. Established standards must be adhered to more rigidly and consistently."

Before concluding this section it should be mentioned that in certain cases we tend to "render unto Caesar problems that are not really Caesar's." Translated, there are numerous improper machine adjustments or faulty operations that will create problems that are easily and erroneously attributed to poor matrix manufacture and careless inspection. Before condemning any new mats as defective, it is important to ascertain that the problem is not with your machine or, in some cases, caused by the relationship between old, worn mats and accurate new mats.

MATRIX PROBLEMS AND SOLUTIONS

Persistent Matrix Difficulties

Apart from the universal "mat problem" of getting operators to make them drop fast enough to insure a profit, there are a number of common matrix difficulties which persistently influence both production and quality. While the quality of composition is probably no worse than it was 20 years ago, the number of so-called mat problems appears to have increased.

Perhaps this is explained by the fact that today's clientele is more exacting, and our own demands less compromising, rather than by merely the result of less serviceable mats. The mats being manufactured today are probably no better nor worse than those purchased in the not-necessarily-so-good old days. Admittedly, some contemporary machine faces have been designed too wide for their respective mat bodies, and consequently there is an increased tendency for sidewalls to be more readily damaged. Apart from factors such as this, basic matrix problems have remained virtually unchanged for many years.

Another, and perhaps more subtle, explanation for many mat difficulties lies in the hands of the operators. As expressed or implied by many Survey respondents, an increasing percentage of operators have become careless. One large firm blamed "the inability or indifference of ½ to ⅓ of our operators to take proper care of mats and machine mechanisms which affect mat performance and life."

A number of other firms mentioned the fact that far too many mats are being bent or otherwise damaged and discarded by operators without their reporting such action. This not only causes shortages, but also delays the machine maintenance that may be causing the damage. And, apart from mats being discarded without notice, many obviously damaged mats are too often allowed to remain in production and contaminate other mats in the font. With a *firm* management policy and a *conscientious* machinist, mat difficulties caused by operator carelessness and negligence can usually be eliminated or at least substantially minimized.

Considering the more apparent causes, unquestionably hairlines, misalignment and varying character drives constitute the three major manifestations of mat difficulties. Considering only the impact of these factors, the Survey has shown they bear a 4:2:1 ratio of relative importance, respectively, as detriments to production and/or quality. The lesser problem of depth-of-drive, as compared to hairlines and misalignment, is best explained by the fact that this inaccuracy is quite often uncovered as soon as new mats arrive. The other problems must develop over a period of time.

Apart from character drive, the thoroughness with which new mats are checked when received can measurably reduce other types of mat problems caused or prompted by defects or inaccuracies inherent in the original mat.

In terms of actual mat loss, i.e., discarded mats, 85% were attributed to four factors, broken down as follows: 35% sidewall damage; 28% bent mats beyond repair; 17% sheared or otherwise badly damaged lugs; and, only 5% resultant from faulty depth-of-drive. The remaining losses were associated with such other factors as ruined combination teeth, normal wear (old age), being burned in metal pot, and a variety of other rather minor considerations.

Turning for a moment to Ludlow mats, the incidence of any matrix problems was indicated by only one in four of the approximately 50% of Survey participants reporting the use of Ludlow machines. Discounting hairlines which accounted for the bulk of the problems mentioned, the remaining sources of discontent were insufficient in number to be conclusive. Several firms did, however, mention having experienced depth-of-drive variations on occasion. Most of the remaining difficulties were related to use and handling rather than to manufacturing limitations. Ludlow mats being handled with perspiring, greasy hands, and the accidental dropping of mats were the most frequently reported causes of internally created problems.

Since reproduction proofs are in a sense our primary "fruit of the punch," it is of interest to note that about one out of every four repro proof problems and/or complaints were attributed to defective, worn, or otherwise inaccurate mats. Hairlines, misalignment, and inconsistent character depth-of-drive were the most persistent offenders. Beyond these, one firm reports that – "Now, as always, with a strong magnifying glass in the hands of an *expert customer,* we can have an infinite variety of mat problems."

The Hairline Problem

Few aspects of linecasting composition have caused so much discussion, theorizing, curative effort and *heartache* as have those insidious saboteurs called "hairlines." Despite the infinite variety of "foolproof" solutions that have been advanced over the years, hairlines remain the major matrix and typesetting problem.

Since the advent of linecasting machines, hairlines have been a frustrating problem to some firms, while to others they have been a much lesser or even negligible problem. Inasmuch as the same matrices and typesetting machines are being used, it could be reasoned – to the contradiction of several popular theories – that the hairline problem is self-inflicted rather than a manifestation of limitations inherent in mats or machine functions.

Yet, despite the fact that the disease strikes some and spares others, many knowledgeable individuals assert that hairlines are primarily resultant from factors which are largely beyond one's ability to control with certainty. As the succeeding sections on hairline causes and preventions are considered, it will at least become obvious that some firms encourage the disease, while others take wise precautions against it. Because of the variety of direct and indirect causes of hairlines, it should be remembered that there can be no *one best solution* to the problem.

Considering the hairline problem per se, it is generally conceded that whenever hairlines repeatedly occur, the matrices between which they appear have broken-down sidewalls, i.e., the matrix casting cell sidewalls have disintegrated, bent inward, or have otherwise been distorted. The sidewall damage then makes it possible for molten metal to get between the matrices to a sufficient depth to reach the printing plane. Why sidewalls experience this damage, and how to prevent it, open the door to a variety of more or less sound hypotheses.

Common Causes of Hairlines

At one time or another, it appears that hairlines have been blamed on almost everything even remotely connected with mats, machines and men. Too often, however, diagnostic efforts have taken the course of least resistance. Although certainly a factor in hairline difficulties, machine mechanisms, for example, have frequently become the scapegoat for the carelessness or shortcomings of men.

In other instances, mats become the whipping boy for difficulties that stem from faulty machine functions. Suffice it to say that the real causes of hairlines can never be determined until the problem is approached in an *objective,* methodical manner.

Turning to the Survey responses submitted in answer to the question – "What have you found to be *the most common* cause of hairlines?" it is interesting to note that 16 *different* factors were reported to be "the most common cause" by a greater or lesser number of firms. In order of "popularity," the following causes were submitted:

23% Impact Damage in the Assembler
19% Metal Accumulation on Spaceband Sleeves
16% Metal Accumulation on Matrix Sidewalls
12% Damage Resultant from Tight Lines
8% Damage Resultant from Loose Lines
6% Use of Bent, Burred or Worn Spacebands
5% Faulty Justification Actions
3% Maladjusted Vise Closing Mechanisms
2% Metal Accumulation on Vise Jaws
2% Maladjusted Quadder Mechanisms

In addition to the above causes, such other factors as inadequate sidewalls originally, the use of damaged, dirty or worn mats, loss of the "false sidewall," etc., were also mentioned. In the case of this latter cause of hairlines, said to occur most frequently in the auxiliary position, this is explained by some as the result of a slight difference between the normal wall of the less used auxiliary position and the somewhat built-up wall, though not hairlining, of the roman matrix position. At any rate, it becomes quite obvious that the incidence of hairlines is attributed to a rather wide variety of direct as well as indirect agents.

It is also important to realize the interrelationships that exist between the supposed causes. Did metal accumulation on the spaceband sleeve cause the sidewall damage? Or, did the spaceband leading begin *after* the matrix wall had first been sufficiently damaged to permit molten metal to get between the individual matrices? This kind of cause and effect relationship extends throughout the generally accepted generators of hairlines, and therefore makes it extremely difficult to ascertain with certainty which straw finally broke the camel's back – or matrix sidewall in this case. More often than not, a hairline problem results from the combination and/or accumulation of *several* causes.

Illustrative of this point, it is interesting to note the advertisements of two different, knowledgeable purveyors of systems for hairline prevention. In one case it is stated that "leaded spacebands cause at least 85% of all crushed matrix sidewalls and resulting hairlines." The other supplier indicates that "about 85% of hairlines originate in the assembler." Apart from the source or validity of the coincidentally identical percentages, these quotes emphasize the widespread lack of unanimity as to causes. In both instances, the problem is ultimately manifest in the defective sidewall of a matrix.

Type metal appears to be the common denominator that links the basic schools of thought regarding the cause of hairlines. The barnacle-like adherence of metal to such surfaces as spacebands, vise jaws, and mats is indirectly the major stimulus to the development of hairlines. Once metal is allowed to adhere to any of these surfaces it is likely to build up in subsequent use until the area and thickness of this accumulated metal is such as to be highly destructive to the sidewalls of matrices.

To this extent, there is general agreement. However, a great deal of controversy exists as to whether the metal causes the original mat damage, or whether other factors, such as impact in the assembler, starts the sidewall damage which *subsequently* invites the entry of molten type metal. In the final analysis, it can perhaps be reasonably concluded that the validity or relative importance of each theory of causation is a function of, and must be based upon, an *individual* font of mats being circulated through a *particular* machine by a *specific* operator!

Before leaving this section, it must be strongly emphasized that in addition to the commonly expressed and understood causes of hairlines, there are a great many more subtle, yet nonetheless damaging, influences that stem from infrequent or improper adjustments of related machine mechanisms; from operator carelessness or laxity; from unclean operating conditions; and, from a general lack of adequate attention to, and concern for, preventive maintenance. The firms who fully recognize the influence of these factors – and act accordingly – are invariably those firms who have eliminated or minimized the birth of hairlines!

Preventing Hairlines

As is similarly the case with certain human ills, prevention of that "metallic infection" called hairlines is perhaps less mysterious and probably better understood than the causes of the disease. Since the origin of hairlines pervades so many aspects of machine operation and maintenance, it stands to reason that the means and methods of preventing the problem extend over an area that is no less extensive.

Before proceeding with the subject at hand, it should be noted that a previous section, entitled "Related Machine Maintenance and Adjustment," has already given some consideration to machine factors which influence mat condition. Since hairlines are normally the printed manifestation of damaged matrix sidewalls, it would be of value to reread that related section in conjunction with this matter of preventing the hairline problem.

Included in the original Survey questionnaire was a query which asked: "If you have had *and cured* a hairline problem, briefly describe your method(s) for eliminating or minimizing the problem." The following sampling of comments are representative of the responses which were forthcoming:

(1) "Our experience has shown that matrix damage rarely occurs in well maintained machines, except through operator negligence. As soon as any trouble becomes evident, it must be traced and corrected *before* extensive mat damage can occur. Machine parts are much less expensive than a font of mats!"

(2) "Clean spacebands, polished on the sleeve side to a high lustre, are the best medicine in our battle against hairlines. By cleaning and checking spacebands *twice* a shift, and by periodically checking the back and front wipers and the lock-up (pot-to-mold and mold-to-mats), we have reduced our hairline problem to negligible proportions."

(3) "Our assembling elevator has been adjusted so that mats do not strike each other and cause sidewall damage. Assembler impact has been minimized by raising the front assembler chute rail and properly adjusting the assembler chute finger."

(4) "The problem has been minimized in our plant by not allowing mats to remain on the floor to be stepped on; by keeping a close check on the cleanliness and condition of our bands; and, by periodically verifying the accuracy of jaw pressures and distributor box operation."

(5) "We have milled our mats back so that when they land in the assembler they do not hit the sidewall of the previous mat. Although too early to say, we think it is going to help a great deal in preventing hairlines."

(6) "Abolishing the careless use of oil on mold wiper, keeping the proper tension on quadders at the moment of cast, and properly cleaning and maintaining spacebands has solved the hairline problem for us."

(7) "We have avoided any hairline problem by scrupulously maintaining the cleanliness of our mats and magazines, and allowing absolutely no metal to accumulate on spaceband sleeves. It is also particularly important that mats be handled only when absolutely necessary."

(8) "Our hairline problem was significantly reduced by immediately isolating hairlined or otherwise defective mats and removing them *before* they had a chance to ruin others in the font. When

a mat goes bad, it is well to carefully check that entire channel for possible replacement."

(9) "While not an absolute cure, Save-A-Mat has served to eliminate much of our hairline problem. Cleanliness of the vise jaws and mouthpiece is also most essential."

(10) "We found our hairline problem was being caused by oxide stains and metal accumulation on spacebands, and we eliminated this using the Ebonite Bandaid System. Also, make darn sure the bands are always turned with the short sleeve to the left of the long wedge."

(11) "The key to hairline prevention we believe is to *properly* maintain and adjust the machine, replace bent and worn spacebands, and instruct operators to justify lines properly so as to avoid both tight and loose lines."

(12) "Although we didn't completely eliminate the hairline problem, we have greatly minimized it by designing and building a machine for cutting a relief notch on the lower left forward corner of the mat which normally would strike the sidewall of the previous mat that had entered the assembler."

(13) "Good housekeeping in and around the machine, magazines and mats, and frequent wiping of such key parts as the distributor box rails, screws, etc., goes a long way in preventing hairlines. Avoid excesses of graphite or oil, use only minimum required."

(14) "Our most troublesome hairline problem was with pi mats, due to the angle at which they come into the pi stacker. We rounded these mats on the bottom right hand side as they are on the left, and this has helped greatly. Seems like this should be done by manufacturers."

(15) "The introduction of later model, hydraulic quadders has prevented hairlining that we believe was caused by the "slapping" action—and sometimes improper tension at cast—of mechanical, inboard quadders against mats. With the introduction of hydraulic justification, the justification action, that is sometimes damaging to mats, should also experience improvement."

(16) "Like apples in a barrel, just one bad mat in an otherwise perfect font can, not only ruin a good job and cause lines to be reset, but can deteriorate a font if not removed. We also keep a close check on the lower case "o" on fonts in daily use. This character is usually the first to show signs of impending hairlines."

(17) "Cleanliness has been our biggest help in preventing hairlines. We have found that sweeping the entire floor twice a day, and washing and waxing weekly, has made a tremendous difference in our machine and mat problems. We are convinced that airborne dirt and graphite causes most of the mat and band problems that are not of course purely mechanical problems or operator faults."

Considering the extent and diversity of the foregoing listing of the more common factors that influence the occurrence of hairlines, it becomes apparent that there can be no step-by-step formula that will *guarantee* the elimination of hairlines. Beyond what has already been stated or implied, there are many other improper and maladjusted machine functions that can contribute to the incidence of hairlines.

For example, if the mold disc forward stroke adjustment is not correct, an undue side friction against the matrices results and becomes a contributing cause of hairlines; if the pot mouthpiece does not recede

from the mold just before the second justification stroke, damage to the matrix sidewalls can occur; if a worn condition of the mold disc studs and stud blocks exists, matrix sidewalls can be dangerously strained when the mold slide recedes from the casting position; and . . . so it goes with many other such examples that might be cited. Suffice to say that the best book of instructions, or listing of adjustments to prevent hairlines, is meaningless without an intelligent, inquisitive machinist or machinist-operator to perform the work.

It would be misleading not to admit that for every few firms who have found the means of preventing or minimizing hairlines, there remains a firm to whom hairlines constitute a continuing source of frustration. One firm went so far as to say: "Hairline problems are hereditary. I attribute my receding hairline to my father!" More seriously, assuming that the preventive potential inherent in maintenance, cleanliness, and operator and machinist education has failed to solve the problem, there are several remaining possibilities that may merit consideration.

A few firms have reported excellent experiences with the Save-A-Mat Deflector supplied with Star Parts assembling elevators as extra equipment. In practice, the Save-A-Mat is supposed to guide each mat downward as it passes over the pawls and prevent the damaging impact with the sidewall of the preceding mat.

According to the questionnaire, only one out of four firms were familiar with Save-A-Mat. Of this group, 15% commented favorably, 70% commented unfavorably, and 15% expressed uncertainty as to its value. Representative unfavorable comments included: "Incomplete solution, hit or miss; trouble on assembly; operators had to pace to slower speed; etc."

A recently promoted method of hairline prevention is Allied Matrix Processing Corporation's (formerly Napman Associates) patented process for providing carefully calculated recessing or beveling in the lower part of the matrix body. The purpose of this recessing is to prevent the beveled or notched parts of an incoming matrix from striking the right-hand casting cell sidewall of the matrix which has already taken its position in the assembling elevator.

The role of assembler impact as a cause of hairlines is no doubt a significant one. In fact, it was, by a slight margin, the most frequently reported cause. Also of interest are the reports of five Survey respondents who have had generally successful results with their own milling or relief cutting of mats to relieve impact in the assembler. For the firm who has *completely exhausted* all other preventive measures, this approach may merit consideration. It should be remembered, however, that assembler damage to mats is *not* a universal problem. The majority of firms have found their remedies without the necessity of machining their mats.

Another device for hairline prevention, based on the claimed elimination of spaceband leading, is the Ebonite Bandaid System. In operation, a wiper is attached in the spaceband chute which applies a metal repellent to the casting point on the band each time one is released for assembly. Like the Save-A-Mat, a limited number of firms have experienced excellent results. For the majority, however, the results have not been too satisfactory. Another contrivance based on the same preventive principle is the Duex Spaceband Cleaning attachment. The section on spacebands will expand on these matters, as well as further explore the peculiar importance of spacebands in relation to hairline prevention.

In concluding this very important section, it might be of value to compare hairlines to reproduction proofs. Using virtually the same methods, equipment and supplies, some firms are able to get consistently good, properly dried proofs, while others experience unending difficulties in their efforts to achieve comparable results. Similarly, using the same methods, equipment and supplies, some firms have no hairline problems, while others are overwhelmed by those insidious fins. This seeming paradox lends credence to the belief that the *human* factor has probably been too often neglected in consideration of the hairline problem. Careful, clean operators combined with an informed, cautious, conscientious machinist is no doubt the best "gimmick" you can use to prevent hairlines!

Hairline "Removal" Techniques

For as long as hairlines have plagued typesetters, there have been a variety of devices and services *guaranteed* to remove them. Since the vast majority of all hairlining mats are characterized by defective or indented sidewalls, the "removal" concept is based on an attempt to eliminate or minimize the influence of this sidewall damage. Through the use of several methods, it has proven possible to sufficiently conceal or temporarily overcome the cause and thereby retard the appearance of hairlines.

The acceptance of hairline deletion techniques has always remained minimal. Our present research indicates that only 14% of firms have ever experienced any degree of satisfaction with removal devices or services. It should be noted that the use of multiple sheets of newsprint or blotter paper at the proof press, to eliminate hairlines in the type form, is beyond the scope of our present discussion.

By far the most common approach to hairline deletion is the accurate grinding or filing of the damaged sidewalls so as to create a minute burr which can serve to retard the flow of molten metal between the matrices. Experience has indicated that such machining of mats can, in some cases, and for some varying length of time, check hairlining. The effect of this grinding does, however, change the set width of mats sufficiently so as to eliminate their further use in tabular work, particularly in the case of figures, quads and points.

The following firms, specializing in hairline removal by machining mats, were each being successfully used by one Survey respondent: Janesville Matrix Economy; Dominion Matrix Service; and Mat Retrievers, Inc. Cost of this kind of service usually runs about $0.08 per mat. One firm reported very successful use of Mat Jig – a device to hold mats while sidewalls are filed. The Mat Jig and "Know-How" are sold for $4.00! And, according to its developer, "the Mat Jig itself is secondary to the instructions for its use."

Another, much less used, technique for arresting hairlines involves the actual pushing back out of the sidewalls with a spring punch and then carefully rubbing the walls on a stone. With the proper care, this can help; however, it is a much too costly and tedious method to use except perhaps for emergencies. Finally, two firms reported the use of yellow soap to build a false wall. Although sometimes successful on partially damaged mats, the cure is at best quite temporary.

As a matter of possible interest, the following are several representative comments, pro and con, concerning hairline removal:

(1) "Accurate grinding will extend the life of larger point sizes up to 18 points, but is not recommended for 8 point or smaller. Fonts cannot be used for tabular work after repairs."

(2) "We use varying grades of emery abrasive, according to the degree of wear. Results not always 100%."
(3) "Special device holds mats accurately for in-plant filing of sidewalls. Permanence of results equal to life of new mats."
(4) "We had 3 older fonts processed about 3 years ago and have been using the mats ever since with no complaints."
(5) "Hairline removal means grinding the sides. Result is temporary and creates other problems with vise jaws, spacebands and Intertype mixer machines."
(6) "We tried milling sidewalls to remove hairlines from mats. The cut was less than .0005" but it still gave us problems on tabular work and alterations on old jobs. Also, it made partial replacement of mats impossible because of difference in total line lengths."

If the limitations are understood and considered tolerable, hairline removal techniques can merit consideration, or at least a trial, under certain conditions. According to our data, their use has not been restricted to the smaller plants; several large, prominent firms have indicated the occasional use of removal devices or related trade services. Unquestionably, however, it is always more productive to find and eliminate the *cause* rather than to treat the symptoms of the hairline disease!

SPACEBAND SUPPLY AND CONTROL

Spaceband Suppliers

According to our Survey, the two major suppliers of linecasting spacebands to the typographic industry are Mergenthaler Linotype and Star Parts, with 39% and 33% of the total, respectively. Intertype follows with 15%, and Schneider – a Swiss made band available from Federico K. Hutzler – has 10% of the total. Spacebands sold by Rich & McLean and Montgomery Co., Inc. ("Montco") account for the remaining 3%.

It is of interest to note that more than ⅓ of the firms indicated the use of two or more spaceband suppliers, depending on particular conditions or requirements.

A small percentage of firms reported having used foreign-made spacebands – Swiss, German and British primarily. Although the Swiss bands rated somewhat better, general experience with foreign-made spacebands has usually been *less* satisfactory than bands manufactured in this country. One firm reported having purchased spacebands, from a foreign source, that were not interchangeable with domestic bands. In light of these experiences, it will normally pay to fill your spaceband requirements from among the wide variety available from U. S. manufacturers.

Types and Designations of Spacebands

To meet differing typographic requirements, spacebands are available in a variety of styles. The distinction between the six or seven styles available from each major supplier is largely a matter of thickness. Starting with a minimum of 2 points, spacebands can be obtained with expansive capabilities that exceed 10 points. The size and style (i.e. expanded, condensed, etc.) of type, as well as the nature of the composition *and customer,* will generally determine the band most suited to any given set of conditions.

It is of interest to note that only 15% of firms have found it possible to operate with only one style of spaceband. The largest group, representing 50%, reported using two styles; 26% indicated three; and, the remaining 9% reported having *four* different thicknesses of spacebands available at all times.

Before considering the styles of bands most used, it might be helpful to consider the distinctions between the bands available from the three major suppliers.

		Lines	Expansive Range		Maximum
MERGENTHALER	**No.**	**or Nicks**	**Min.**	**Max.**	**Expansion**
Extra Thin	J-3568	2	.028"	.0943"	.066"
Wide Range	J-4391	5	.0345	.1194	.085
Thick ("Regular")	J-3556	1	.0375	.1035	.066
Special Taper	J-3572	4	.0369	.1219	.085
Teletypesetter	J-6453	6	.0369	.1219	.085
Extra Thick	J-3560	3	.046	.146	.100
STAR PARTS					
Extra Thin	M-20-2	2	.028"	.0925"	.064"
Thin	M-20-3	3	.032	.096	.064
Wide Range	M-20-5	5	.0345	.121	.087
Medium ("Regular")	M-20-1	1	.039	.103	.064
Wire Service	M-20-7	7	.037	.124	.087
Special Taper	M-20-4	4	.039	.125	.086
Extra Thick	M-20-6	6	.047	.143	.096
INTERTYPE					
Extra Thin	T-668	—	.028"	.092"	.064"
Extra Thin	T-1768	—	.030	.0835	.053
Thin	T-401	—	.032	.096	.064
Ideal Thin	T-3711	—	.032	.1175	.085
Ideal ("Regular")	T-2932	—	.037	.1225	.085
Thick	T-400	—	.0375	.1015	.064
Extra Thick	T-656	—	.048	.144	.096

Although certain of the style names are the same from one manufacturer to another, there are subtle differences in expansive capabilities among these bands. In terms of popularity *within* each grouping: Mergenthaler's Extra Thin (J-3568) and Wide Range (J-4391) are most prevalent, with the Wide Range more commonly used; Star Parts Extra Thin (M-20-2) and Special Taper (M-20-4), with the Extra Thin enjoying by far the greatest use; and, in the case of Intertype, the Extra Thin (T-668) and Ideal (T-2932) are most popular, with the Ideal ("Regular") in more frequent use.

The selections made from among the available styles of spacebands can influence both quality and quantity of composition. As a general rule, the expansive range should permit the greatest flexibility in justification that is consistent with good word spacing. The tendency to use thicker bands to facilitate justification at the expense of word spacing must be continually restrained. To the extent possible – and practical, the same tenets of good spacing that prevail in hand composition should influence spaceband selection.

Generally, extra thin bands are used for quality publications, book work and the smaller sizes of type to about 10 point. In the case of condensed faces, extra thin bands might be appropriate in sizes up to 14 point. Although the commercial composing room normally uses wide range for most of this kind of work, the typographic plant often must sacrifice this flexibility to pacify either customer or self-imposed demands for tight word spacing.

Widely varying typographic conditions and attitudes make it impractical, if not impossible, to be more definitive as to specific applications for each spaceband style. While under certain conditions one firm might find it practical to use regular thin spaces in conjunction with bands, another firm would insist on changing to a thicker band. And, the spacing that is quite salable for one plant would perhaps be highly offensive to the customers of another. Suffice to say that the selection and application of the varying spaceband styles must be determined on an individual plant basis within the confines of acceptable spacing and efficient machine operation.

Spaceband Complement on the Machine

Regardless of the type of bands being used, it is essential that the set contain a full complement. If spacebands are used in insufficient quantity, each band may be in use more frequently than is desirable. It is reasonable to assume that the more bands there are, the less tendency there is for each of them to accumulate metal and require maintenance. And, if the quantity is sufficiently reduced, it will of course begin to impair the continuity of machine production.

In tabulating the response to a related question, we find that the average firm normally keeps between 27 and 28 spacebands on each machine. More specifically, 38% kept 30 bands; 30% kept 28 bands; and 19% indicated maintaining 25 spacebands on their machines. Only 13% of firms reported using *less* than 25 bands.

Ideally, 30 spacebands should be maintained on each machine. Within a range of from 26-30 is normally considered satisfactory. Policy should, however, make it clear that 25 spacebands is to be considered the absolute minimum. Strict enforcement of this shop rule will pay dividends.

Replacement Spacebands and Associated Parts

Surprisingly, there are firms that do not maintain even one *extra* set of spacebands. At the other extreme, there are firms that have a replacement set of bands for each machine. Somewhere between these two points, we find the majority who maintain replacement spaceband sets, in the required types, but not necessarily for each machine.

Although such factors as number of machines, different types of bands in use, accessibility to the source of supply, etc., will influence the decision for each plant, there is merit in having a replacement set, of at least the commonly used bands, available for *each* machine. These bands can, for example, be used by the operator while his regular set is being cleaned and polished. In this way, the operator always has a full set of bands available to prevent any lost time waiting for bands to be cleaned. The convenience of this approach often makes it practical to clean bands more frequently.

Whether complete replacement sets are available or not, it is very worthwhile to maintain a supply of each type of band in plant use for the purpose of replacing individual bands that break, bend, or otherwise become defective. The extent to which bands are repaired will influence the quantity of replacements required.

According to the Survey, one out of three plants purchase replacement parts for spacebands and/or interchanges the salvaged parts of discarded bands. Since sleeves are more frequently impaired, it is this part that is usually purchased to use with available wedges. Although Intertype no longer sells replacements, the other major suppliers continue to do so. Apart from a very small school that believes sleeves and wedges must be "lapped" together, it is generally felt that the precision manufacture of today's spacebands makes the interchangeability of slides and wedges both precise and practical.

Spaceband Inventory Control

Having previously emphasized the importance of maintaining the desired complement of spacebands, it is appropriate that some consideration be given to means by which control can be exercised over the inventory of spacebands in the plant.

According to the Survey, 43% of firms have some system, be it formal or informal, which serves to indicate when additional bands must be ordered. While we cannot assume that all of the remaining firms experience "emergency" shortages from time to time, we can anticipate the increased likelihood. Regardless of the particular method used, it is most important that some person – usually the machinist – be delegated the responsibility of insuring the maintenance of an adequate inventory of spacebands at all times.

Generally, control is exercised at the time of cleaning. This daily routine provides an ideal opportunity to inspect and *count* the bands on each machine. If shortages are noted, these should be explained by the operators in question, and replacements made immediately. The inventory record of replacement bands should be diminished accordingly so that additional spacebands may be obtained when the supply of extras reaches its predetermined minimum level.

Interestingly, several firms have reportedly enhanced their control by numbering the spaceband sets according to their respective machines. Apart from restraining the improper removal of bands from one machine to another, this approach can prove useful in relating spaceband losses and defects to the operation of particular men and/or machines.

For that limited number of firms who have found it advantageous to periodically replace complete sets of spacebands on an annual or biennial basis, the purchase date of each new set is usually kept on record. This type of routine replacement program is, of course, unaffected by the interim replacements that may be required as a result of defects developed in the course of normal operation.

SPACEBAND MAINTENANCE

Spaceband Cleaning – An Important Responsibility

In responding to a question related to the cause of hairlines, one firm promptly answered – "How do I know?" Several pages later in the questionnaire, when asked who is normally assigned the task of cleaning spacebands, the same firm indicated that band cleaning was assigned to the *janitor*.

Without belaboring this case in point, suffice to say that far too many plants do not give spaceband maintenance the degree of attention that is amply justified by the notable role that bands play. The cleanliness and condition of spacebands exerts a direct and profound influence upon

both machine operation and the longevity of matrices. In the latter case, even one defective or improperly cleaned spaceband can, if left in operation, rather quickly result in substantial mat damage and dollar loss.

According to our Survey data, the largest group of personnel engaged in spaceband cleaning are apprentices, accounting for 41% of the total. (This category includes a 5% grouping of machinist apprentices.) The next largest group, with 29%, consists of *machinists;* operators account for 20%; and the remaining 10% are comprised of a variety of relatively low-level, miscellaneous employees that have been assigned the task of spaceband cleaning.

It is of significant interest to note that about one out of three firms consider spaceband maintenance of sufficient importance to have assigned this responsibility to their machinist or machinist-operator. In other instances, the machinist is specifically charged with the responsibility of supervising the maintenance performed by operators or apprentices.

Cleaning spacebands by hand is generally viewed as a "dirty job," and for that reason is often hastily and thoughtlessly assigned to the lowest man on the production pole. As previous sections have strongly implied, this attitude can, and in many cases does, prove highly expensive and inefficient. One of the basic keys to solving the hairline problem, for example, lies in recognizing that the often dirty and tedious job of cleaning spacebands is a highly important assignment. In a well regulated plant, it is understood to be a vital chore in connection with the operation of linecasting machines, and those engaged in this responsible activity are therefore selected from the *top* rather than the bottom of the production team.

Although spaceband cleaning machines have eliminated much of the "dirty job" for many firms, the necessity for careful *inspection* of the bands at each cleaning remains a responsibility that is too important to be improperly delegated.

Frequency of Spaceband Cleaning

In conjunction with their controlling mechanisms, spacebands are designed to perform three vital functions: (1) To drop quickly and accurately during assembly; (2) to slide freely during justification; and, (3) to lockup tightly between the matrices, giving a metal-tight seal that in no way causes injury to adjacent matrices. To insure that these essential requirements are properly accomplished, spacebands *must* receive proper, periodic maintenance.

Although a variety of factors will influence the desirable frequency with which spacebands should be cleaned and polished, it is generally agreed that 8 hours of service be considered a maximum interval between cleanings. Ideally, bands should be cleaned every 4 hours. Our data indicates that, under normal operating conditions, 87% of firms clean bands once every 8 hour shift. Of the remaining firms, 8% regularly clean *twice* a shift, and 5% do so only once every other shift. At this point it should be emphasized that the *carefulness* of the cleaning effort is equally as important as the frequency.

Apart from the necessity of cleaning and polishing bands more frequently on tape-operated machines, certain types of work — such as bookwork, for example — will make this maintenance necessary more often. In some plants, on damp or rainy days spacebands may have a tendency to stick, and sleeves not slide smoothly. Rather than risk damage and/or delays, it is often wise to give bands an extra cleaning

on such days to avoid any difficulty. Also, as mentioned previously, the fewer the spacebands there are in a set, the more often each one is used, and the more frequently the set should be cleaned.

It is well to note that new spacebands are sometimes more subject to collecting metal than spacebands which have been polished to a high lustre from continued cleaning. Until the high lustre is achieved, it may be necessary to clean bands more frequently than normal.

Because of their constant usage and the strain imposed during justification, it is essential that spacebands receive an adequate amount of important, daily attention. If spacebands are used without frequent removal of the oxide stain that collects in the area adjacent to the casting recess, this stain soon begins to retain particles of metal which inevitably lead to the destruction of matrix sidewalls. It becomes obviously important why bands must be frequently cleaned, preferably *before* any of these particles of metals are allowed to adhere.

Because of the speed and cleanliness with which spaceband cleaning machines operate, bands that are cleaned and polished by them often experience increased maintenance. If you are of the opinion that more frequent attention to your bands would be of value, a band machine may provide a convenient, painless answer.

Apart from aiding the smoothness of justification, the thin film of graphite acts as a non-flux and slows adhesion of metal to spaceband sleeves. The ability of graphite to form this protective coating further emphasizes the utility of frequent spaceband polishing.

Spaceband Cleaning Methods

Regardless of the specific method employed, the objective of spaceband cleaning remains the same, i.e., to polish the entire band – the sleeve and both sides of the full length of the wedge. The purpose of this operation is two-fold: (1) to remove the oxide stain and any traces of metal that may be accumulating near the casting edge of the sleeve; and, (2) to provide lubrication for the sliding of the wedge so as to reduce friction between the sleeve and the wedge, and the matrices. Careful *inspection* of the bands is, of course, an important associated consideration.

Surprisingly, despite the many refinements in typesetting methods and equipment, spaceband cleaning has continued to defy mechanization. Our study reveals that 84% of firms continue to use hand cleaning methods exclusively. And, of the remaining 16% of firms using spaceband cleaning machines, one-third indicated the occasional, supplementary use of hand cleaning techniques. It is perhaps paradoxical to think of such sophistication as computerized justification decisions being carried out through the use of spacebands that are maintained by hand rubbing, on a board coated with graphite, in a manner that is as old as the wedge principle itself.

Although spaceband cleaning machines have been around for many years now, they have never enjoyed widespread use. This is perhaps explained both by the limitations of these machines and the reluctance of many plants to entrust this highly important responsibility to a machine. Some firms have compromised this situation by using hand cleaning as an adjunct or supplement to machine cleaning. The recent introduction of a new, improved spaceband cleaning machine – The Minuteman – may eventually exert some influence in attitudes toward spaceband cleaning. This device, as well as cleaning machines generally, will be discussed in a later section.

Queries into the time spent per machine in cleaning spacebands reveals that machine cleaning is approximately twice as fast as hand cleaning. The arithmetic average time for machine cleaning was 4½ minutes, as compared to ten minutes per set in the case of hand cleaning. The range reported in the case of the former was 2 to 10 minutes, while the latter (hand cleaning) times ranged from 3 to 20 minutes per machine.

The degree of care exercised, and the thoroughness of the inspection, will greatly influence the time spent per machine in cleaning spacebands. Steps must be taken to insure that sufficient time is available – *and used* – to do the job carefully and completely. The old adage "haste makes waste" is quite appropriate in the case of spaceband cleaning. And, the waste can get quite expensive!

Hand Cleaning Spacebands

Proper hand cleaning of spacebands requires concentration. In many cases, however, the job is done in a highly *subconscious* manner, while the cleaner fills his eyes and mind with more interesting matters. The importance of this assignment makes it essential that the operation be systematized both in practice and procedure.

According to Survey data, 95% of firms using the hand cleaning method report having to some extent standardized the actual procedure so that all who clean bands use precisely the same motions and techniques. Ideally, it is always better to have this responsibility vested in one individual whenever possible. And, as previously mentioned, the machinist or machinist-operator would no doubt be the best person to do the job.

Generally, hand cleaning involves the careful rubbing of bands on a smooth, perfectly flat surface coated with a dry graphite lubricant. The key to the cleaning operation is the motion, which should involve uniformly moving the band back and forth in a lengthwise direction while being held under moderate pressure. Sidewise or circular polishing must *never* be tolerated, as it will quickly wear down the band's sharp edges. Once a band has been rounded in this manner, particularly at the casting edge, the entrance of metal between the band and its adjacent matrix becomes inevitable.

In addition to the conventional cleaning just described, several firms have reported quite successful use of a very slight amount of mold polish on the sleeves, applied by rubbing onto the sleeve using the wooden edge of the cleaning tray or other appropriate surface. Before returning bands to the machine, they should be tapped lightly on the board until all loose, excess graphite has been removed.

Apart from improper rubbing motions, one of the most common problems in hand cleaning is the tendency to use *too much* graphite. It is far more important to have the bands clean than just coated with graphite. Machinists are in agreement that a good *cleaning* surface is of much greater significance than merely having a "lubricating board."

Based on our study, we note nine different surfaces or woods being used in conjunction with the hand cleaning of spacebands. These include such woods as: Pine, mahogany, plywood, maple, fir, oak, cherry, etc. By far, the most commonly used surface is a smooth, soft white pine. Several firms have also reported very satisfactory experiences using the coarse side of a masonite board. Irrespective of the type of board used, the surface must be perfectly level, relatively smooth, non-damaging, and capable of efficiently cleaning the bands.

Despite the merits, few firms indicate the use of two surfaces – one for cleaning and the other for lubricating the spacebands. And, only about one out of four firms reports changing or renewing their cleaning surface when it becomes "glazed" with graphite. In the majority of cases, the spaceband cleaning surface is only replaced or restored as the result of wear, i.e., when the continual rubbing of bands has created depressions which make the surface rough, uneven, or otherwise distorted. Considering the relatively insignificant cost of the actual surfaces used to clean spacebands, these should be periodically changed to insure the accuracy and uniformity of spaceband cleaning. Contrary to popular belief, the spaceband cleaning board grows *less* – rather than more – efficient with age.

Considering the lubricant, 99% of firms report the use of Dixon's dry graphite. With 89% of the total, Dixon's No. 635 Graphite (Finely Powdered Flakes) is by far the most popular. The remaining firms use Dixon's Microfyne Graphite (Extra Finely Powdered Flakes.) Other polishing agents have been experimented with in the past, but dry graphite remains best for the purpose. When properly applied, only a minimum amount of graphite is required to provide lubrication for the spaceband's sliding wedge so as to reduce friction between the sleeve and the wedge, and the matrices as well.

Before leaving this matter of hand cleaning spacebands, a word about the removal of metal accumulations from the sleeve would be appropriate. In the well regulated plant metal on sleeves is a rarity. Normally, the very slight oxide deposits are removed in the regular course of daily rubbing the bands on the polishing board. There are some firms who, should a significant amount of metal accumulate, do not even attempt removal but rather discard the band or sleeve.

The majority of firms do, however, find it necessary and practical to remove such accumulations on those infrequent occasions when they result. Of these firms, 74% report having found the use of a brass rule quite satisfactory for removing such accumulations. The remainder indicated employing such other devices as wood, crocus cloth, razor blades, steel rule, machine slugs and hard rubber. When using any very hard, sharp and/or abrasive means, extreme care must be exercised to avoid damaging the band sleeve. Several firms have had good results using mold polish to remove such accumulations. The best method is *preventive maintenance!* If accumulations become the rule rather than the rare exception, steps should immediately be taken to determine the *source* of the difficulty.

Spaceband Cleaning Machines

Considering the length of time that spaceband cleaning machines have been available, it is surprising to find that more than half of the Survey participants had *no* experience with such devices. Of those firms having had cleaning machine experience, one out of three firms reported favorably.

In terms of popularity, the Twin Oaks or Romyns Spaceband Cleaner (Hartzell Machine Works) is most widely and satisfactorily used at present. The Hartco Spaceband Machine was reported by only a few firms. The latest entry into the spaceband cleaning machine field is the Minuteman Spaceband Machine (Elfo Co.) which, because of its newness, was only being used by one firm. Their favorable comment indicated that "it effectively polishes the sleeve and friction side of the wedge and deposits only the amount of graphite needed to insure good justification."

In operation, the motorized Minuteman Machine gives each band four revolutions of a circular pine disc, while being hold under twelve-pound pressure by a spring actuated plunger. The circular lapping block is made of laminated pine wood, and is mounted on an iron disc running on a true level. Operation of the machine is smooth and precise, and the cleaning action appears quite positive.

One of the major objections to spaceband cleaning machines has been their ineffectiveness in removing metal accumulations from the sleeve. Although various knife blades have been incorporated into the machines for this purpose, they have not satisfied many users and, in some cases, they reportedly have removed or otherwise damaged or scratched the sleeves. This latest entry, the Minuteman, provides no supplementary cleaning blade on the premise that none should be required if bands are properly and frequently cleaned.

Another, relatively recent, spaceband cleaning machine is the Gossen Automatic Spaceband Cleaner (Ralph H. Mort Company). No user experiences were available on this automatic device for band cleaning and lubricating.

As a matter of possible interest, a number of pro and con quotes have been extracted from the Survey responses. In fairness, it should be noted that none of these are related to the Minuteman or Gossen machines. The majority are based on experiences with Hartzell and, in a few instances, Hartco machines. Representative favorable comments included:

(1) "Excellent, wouldn't be without it."
(2) "Time saved is considerable, bands are usually very clean but are inspected anyway and, when necessary, checked and cleaned with a brass rule."
(3) "Much faster, uniform job. Better than relying on the thoroughness of an apprentice."
(4) "Fast and thorough. Allows me the time to have them done twice in one shift."
(5) "Machine is a timesaver and is an efficient cleaner if properly treated and used, and if the bands are done carefully. Defective bands should never be allowed through the machine."

The following Survey quotes are of a less favorable nature:

(1) "Time savings, yes. Cleaning efficiency, no. No type of inspection can be done when spaceband cleaning machine is used exclusively."
(2) "Machine tends to damage, and sometimes even break, spacebands – particularly sleeves."
(3) "Removal of metal accumulation from sleeve is not effective."
(4) "Not effective or consistent enough in cleaning and lubricating. Have to hand clean on graphite board occasionally."
(5) "Do not believe machine cleans as well as by hand. Don't feel that the five minutes per machine per day spent in hand cleaning spacebands is wasted time."

Such factors as the general condition of spacebands, frequency of cleaning, attitude, care, etc., will, of course, influence one's experience with cleaning machines. For example, the firm that has a constant accumulation of metal on spaceband sleeves will no doubt find the machine a great deal less satisfactory than the firm whose accumulations remain negligible. And yet, the increased frequency of cleaning that is usually possible with a machine might eventually help the firm who initially finds the machine unsatisfactory.

At any rate, it is strongly recommended that all firms at least take advantage of the trial offers made by the suppliers of spaceband cleaning machines. For those firms who have had bad experience in the past, recent machine developments and improvements justify a second experiment. The new model Twin Oaks Spaceband Cleaner and the recently announced Minuteman Automatic Spaceband Machine are perhaps the two best machines available today.

Spaceband cleaning devices attached to the spaceband box will be considered in the section on metal repellents.

Solvent Cleaning of Spacebands

When questioned as to the use of oil-free solvents in connection with spacebands, 47% of firms indicated their occasional or regular use to remove oil, dirt, hardened graphite, or other contaminants from spacebands. Apart from the washing done to remedy accidental contamination, several firms reported the routine use of a solvent to remove "gum" that they had found to accumulate under the sleeve, or simply as a periodic supplement to conventional cleaning.

No less than 20 different oil-free solvents were reportedly being used in conjunction with spaceband washing. White gasoline and naphtha were indicated most frequently, followed by carbon tetrachloride and various typewashes. Other solvents reported by more than one firm included: benzine, Chlorothene NU (Dow Chemical), mineral spirits, and Standard Oil thinner #200. Because of their highly poisonous nature, carbon tetrachloride and benzine, in particular, should be used with extreme care.

The judicious use of an appropriate solvent can at times provide a helpful adjunct to regular spaceband cleaning. However, it is extremely important that bands be *thoroughly* dried and properly lubricated before they are put back into service.

Cleaning the Spaceband Box

That simple, open frame above the assembling elevator – known as the spaceband box–can measurably influence the effectiveness of spaceband performance. If dirt is allowed to accumulate in the box, bands will begin to hesitate in delivery. Occasionally, gummy substances on the "floor" of the spaceband box will prevent the bands from sliding forward easily.

Operators who experience bands piling up in the spaceband chute, or clogging the assembler, are usually inclined to think the spaceband mechanism in need of repair. While this is sometimes the case, the best rule is never to conclude the mechanism itself is at fault until one is certain that it is *clean enough* to operate properly. Spaceband boxes and chutes which have become coated with excess dirt will often result in operating troubles that may easily be mistaken for faulty pawls or other causes.

In answering the question – "How often do you clean the spaceband box?" – the very wide range of from "never" to "once in five years" was reported. Of the more than 50% who did so on a regular, periodic basis, the majority fell into the daily, weekly or monthly category. Weekly cleaning was most often reported. Of the remaining firms, 25% noted cleaning only when malfunctioning makes it necessary, or when the pawls required attention.

The most prevalent cleaning method was through the use of compressed air and/or a brush. In cleaning gummy substances from the

floor of the spaceband box, without removing the box from the machine, the use of a slender stick of wood or matrix hook wrapped with a cloth soaked in white gasoline was considered a satisfactory method. In addition to cleaning, the spaceband box – particularly the front and back top rails – should be periodically examined for nicks, burrs, or other imperfections that may influence spaceband life and performance.

Using Metal Repellents on Spacebands

It is generally agreed that by preventing the adhesion and build-up of type metal on spaceband sleeves, a major cause of hairlines is eliminated. For most firms, routine cleaning and inspection serves to eliminate the damaging influence of accumulated metal. If bands are properly maintained, and build-up continues, it is quite likely that factors are involved beyond the bands themselves. In some cases, the use of "metal repellents" has been found to be a helpful *adjunct* to conventional spaceband polishing.

Survey data indicates that 20% of firms use some so-called repellent to remove and/or retard metal adhesion. In practice, the application of these repulsing agents to spaceband sleeves is usually accomplished in one of the following ways: By hand rubbing onto the bands at the time of cleaning; as an integral part of spaceband cleaning machine operation; through the attachment of an applicator to the spaceband box or chute plate; or by spraying from a pressurized can. The use of metal repellents for other machine parts, such as on jaws and back mold wiper, is beyond the scope of our present spaceband discussion.

Of those firms reporting the use of metal repellents on spaceband sleeves, six use Dixon's Mold Polish, four use Bandaid Metal Repellent (Ebonite), and two firms each reported using Metrisil (Matrix Contrast Corp.) and Metl-Repl (Central Type & Supply). The following agents were each reported by one firm: Slic (Star Parts), E. J. Lubricant, and No-Mel. If mold polish is used, it should be noted that these polishes generally contain a very fine abrasive, which makes it important that the application to sleeves be done with care and accuracy, preferably with a polishing block. Excess polish should be thoroughly wiped clean with a cloth.

Among the users of repellents there was a considerable divergence of opinion regarding treatment life and effectiveness. Those applying repellents by some hand means generally reported finding it necessary to renew the film on a weekly basis. A few firms indicated doing so every time bands were cleaned. In the case of felt applicators used on the machine or in conjunction with a spaceband cleaning device, one or two drops of repellent per week seemed to provide sufficient protection. All methods considered, experiences ranged from "hardly any difference" to "completely effective in preventing accumulation." Those firms indicating highly satisfactory experiences represented about two-thirds of the total users, who in turn constituted only one out of five of the total firms reporting.

In many cases, promoters of various metal repellents, and related systems, have *improperly* stressed the use of these agents as a means of eliminating or substantially reducing the necessity of conventional spaceband cleaning. Both experience and good judgment indicate that, at best, repellents cannot completely perform the polishing and lubricating functions that are essential to efficient spaceband performance. Without the proper film of graphite, good justification is hardly possible. Among the current users of repellents, no one indicated having

eliminated other cleaning methods and only 8% reported any significant reduction in their frequency of cleaning.

Because of the very favorable experiences of a limited number of firms, some additional mention should be made of the buffing devices which are attached to the spaceband box or chute. The most frequently noted of these gadgets was the Ebonite Bandaid System. Although never having enjoyed very widespread use, the four firms that indicated its use all reported highly favorable experiences. It is also of interest to note that the country's largest printing establishment, with some 180 linecasting machines, has Bandaids on all of them.

In practice, the Ebonite System is comprised of a modified spaceband chute end plate that is arranged to permit the attachment of an applicator, which is essentially a felt wiper backed by a light spring. The crux of the system is the metal repellent which the wiper applies to the casting point each time a band is dropped for assembly. In addition to the microscopic repellent film, the wiper is claimed to remove any loose flakes of metal which may have been carried over from the preceding cast.

Another, similar device which has found some successful application is the Duex Spaceband Cleaner. The PARKOplate system, promoted a few years ago, was not reported by anyone. For those firms to whom metal accumulation on spaceband sleeves constitutes a continuing source of difficulty, the very modest cost of these buffing attachments – Bandaid is about $15.00 – would easily justify a trial. If it does prove useful, it then becomes important to avoid the tendency of forgetting to polish and lubricate bands in the normal manner. The use of metal repellents must be viewed as a *supplement* rather than a replacement for periodic band cleaning. It is also important that the *source* of any excessive and persistent leading problem be found.

As a final comment on the subject of spaceband leading, a question was raised to determine whether any relationship existed between the degree of metal adhesion and the brand of spaceband used. According to the responses, only 18% of firms found this to be so; 47% indicated no relationship; and, the remainder of firms had no basis for comment, either because they had always used the same bands or had never made a comparison check. When asked whose bands showed the least buildup, the responses followed essentially the same frequency as band popularity reported previously.

Spaceband Repair

When questioned regarding the extent to which spacebands were repaired, 54% noted "always if repair is possible," 31% indicated "occasionally," and 15% stated that they "never" repair spacebands.

Because of the extreme importance of accurate spacebands, and the adverse and costly results of using defective bands, it is perhaps understandable that a large percentage of firms never repair bands or will only undertake the most minor of repairs. As one firm puts it – "We have repaired in the past but have found it ultimately more costly in damage than any possible savings in the cost of new spacebands."

The most frequent, and perhaps most practical, aspect of spaceband repair is that of replacing sleeves or wedges. Done carefully, replacing these parts can very effectively restore many bands to useful service. Small burrs can also be efficiently removed. However, when it comes to bent bands, it is generally wiser to replace the band or the defective part. If the bend is very slight it can sometimes be easily straightened.

It is most important that the accuracy of the repair be verified beyond question. When in doubt, never put a band into service. The use of questionably accurate bands is indeed false economy when viewed in light of their influence upon the longevity of matrices.

As an interesting sidelight, defective or broken spacebands provide an excellent steel material for grinding a variety of small tools, such as screw drivers or engraving tools.

SPACEBAND QUALITY ASSURANCES

Measurements to Verify Accuracy

To insure a tight lockup and prevent damage to matrices, it is essential that the measurement of the sleeve and wedge together at the casting point on the spaceband should equal or slightly exceed (by about .0005") the measurement on the opposite side. Under no circumstances should the measurement be less. As an additional safeguard for tight casting lockup, the spaceband sleeves are slightly hollow in the center. For these reasons, bands must always be put into the machine with the sleeve to the right.

Surprisingly, in light of its importance, only one firm out of four indicates the periodic use of a micrometer to verify this measurement. The greatest percentage of these firms indicate doing so on a monthly basis. Of those who do not conduct such verification on a regular, periodic basis, it is usually done only when necessary or when bands are suspect. When this condition exists, it quickly manifests itself as excessive metal accumulation on band sleeves and/or hairlines. If left unchecked, damage to matrix sidewalls inevitably soon follows.

On old machines it may be possible to secure satisfactory results with spacebands that are worn and rounded, and with front lockup adjustments that are slightly off. This is perhaps explained by the gradual building up of false sidewalls on matrices, and the fact that this condition of worn spacebands or inaccurate adjustments came about quite gradually. However, when new matrices are put into circulation, trouble will invariably be experienced because of worn conditions in the machine and spacebands.

Apart from the miking of the casting face dimensions, the bands should be periodically examined with a knife straight edge – or with a new piece of hairline rule – to insure that the corners of the sleeves, particularly at the casting point, have not been rounded. If such wear is noted, new sleeves should be applied or the spaceband discarded.

Periodic Inspection of Spacebands

The spaceband is used more frequently than any other character, and it takes more abuse in casting and justifying. Because of this, and because of the spaceband's key role in efficient linecasting composition, it becomes obvious that the condition of spacebands should be frequently inspected. Clean, accurate spacebands are, in a very real sense, your best *matrix insurance!*

As an impressive example of the importance of periodic inspection, the case is cited in which a typographic plant was experiencing matrix damage in the form of a scoring on the upper portion of the right side of the matrices. This plant had about 75 magazines, and the mats were scored in proportion to the use they had received. In a very short time it was almost inconceivable how many mats showed this scoring caused by *one* damaged spaceband on *one* of their three machines. The top

of the wedge was scoring the matrices. Fortunately, in this case the damage was above the casting point of the matrices, but it vividly emphasizes how quickly *thousands* of dollars worth of matrices could be ruined! Careful inspection of spacebands *daily,* when cleaning them, is not only good maintenance but good *insurance* as well.

According to Survey responses, about 85% of firms report inspecting bands at each cleaning. However, the *thoroughness* of this inspection obviously varied between firms. In the case of those firms using spaceband cleaning machines, bent bands become obvious because of their inability to go through the machine properly. After machine cleaning, many firms inspect for bands that may require hand attention. Although not usually practiced, it is useful to inspect the condition of bands *before* as well as after they are cleaned. It is of interest to note that a few firms felt spaceband inspection of sufficient importance to justify it being done twice each shift.

In addition to checking bands for quality, inspection should also involve verifying the *quantity* of bands in each set. It is also a good practice to inspect for "wrong font" spacebands whenever bands are cleaned. In most cases, the distinguishing lines on the lower front edge of the bands facilitate this determination.

Inspection of spacebands should prompt immediate corrective action whenever it is indicated. Abnormal accumulations of metal on spaceband sleeves can, for example, be indicative of one or more of the following factors: poor previous cleaning; mechanical difficulties such as improper lockup, etc.; mats in use with defective sidewalls; or, perhaps, a bent or improperly straightened spaceband. In many cases, conscientious inspection will isolate symptoms that can often be remedied *before* the "disease" reaches the point of no return.

As previously illustrated, faulty spacebands that are not removed by inspection can quickly damage a great many mats. Since typographic plant efficiency and quality depends to a very large extent upon the condition in which its "tools" are maintained, a well kept shop constantly insures that no defective spacebands are allowed to remain in use.

SPACEBAND PROBLEMS AND SOLUTIONS

Frequent Causes of Spaceband Loss

By far the most frequent cause of spaceband discard and/or repair is the matter of bent, "warped," or broken bands. Statistically, this category of loss was reported to consume 84% of the total. Of the remaining causes, 7% were charged to permanent metal damage to sleeve; 5% were due to rounded sleeve edges caused by careless cleaning and/or wear; and, the final 4% were attributed to a shy micrometer reading of the sleeve and wedge at the casting point.

The major cause of spaceband bending or breakage was related to one-band lines, and tight lines generally. Whether a tight line, especially a one-band line, will bend a spaceband is largely dependent on machine adjustments. Ideally, if a machine will take the line, it should not bend the band – even in a tight, one-band line. Other, less prominent causes of band bending and breaking include damage done by improper or inexperienced cleaning of squirts, machine malfunctions, accidents or just plain carelessness.

Consideration of the justification mechanism quickly reveals why many spacebands are bent, and why damage most frequently occurs

in one-band lines. During justification, the entire drive of the two largest springs on the machine is brought to bear on the bottom of the spacebands. Because a spaceband is tapered, its thinnest and weakest point is at the top. Therefore, when the full drive of the justification springs is exerted against the weakest point of the spaceband, it is going to bend unless the related machine parts are properly adjusted. And, to further aggravate an already critical situation, it must be remembered that the first justification is always made with the justification bar at an angle, which places still greater stress on the spaceband wedge.

To eliminate this prime cause of costly spaceband damage, check the adjustment of the justification springs and the angle of the justification bar. The amount of angle on the first drive of the bands is very important, because it is at this point that most bending occurs. Today's increased demand for tight word spacing has made the use of extra thin spacebands quite prevalent. Needless to say, the thinner the band, the more readily bending takes place.

Apart from machine adjustments, many firms have found it practical to grind additional "teeth" into the justification bar. With the bar slightly serrated, slippage of the wedge to the left on the bar at the time of justification can quite often be eliminated. In addition, the justification bar should be frequently wiped clean of excess graphite, oil, or foreign matter which might adversely influence justification or contaminate the bottoms of the spaceband wedges. If the bar is glazed or slippery, and bands tend to "skid," it is sometimes helpful to rub crosswise with an oil stone to slightly roughen up the justification bar.

Finally, it should again be emphasized that bent bands must be removed from the machine immediately—*before* they are able to take their toll in ruined matrices!

Persistent Spaceband Difficulties

"From a production and/or quality standpoint, what is your most persistent spaceband 'problem' or concern?" The answers to this Survey question revealed that approximately ⅓ of all firms had no difficulties or concern in regard to spacebands. The remainder of firms reported the following factors as more or less problematic: Cleaning and related activities, 20%; bent or broken spacebands, 17%; metal adhesion and similar difficulties, 10%; and, 6% noted getting damaged spacebands removed immediately as being their major difficulty.

Other sources of spaceband discontent included: Band mixup causing problems of unequal spacing; burrs on band wedges caused by justification bar; having to use delicate, extra thin bands; and, the necessity to frequently change band thicknesses. Altogether, these factors represented only 8% of the total.

The manner in which most of these difficulties can be avoided has already been discussed to some extent. By way of summation, the following quotes from the Survey merit your attention:

(1) "We do not have any particular problem with spacebands. We have standardized on two thicknesses of bands of the best quality available. Particular stress is placed on keeping band sleeves free of any formation, and upon the *immediate* removal of worn or warped bands."

(2) "Our spaceband problems have been made negligible by constantly checking to insure the effectiveness of cleaning; by checking sets to remove bent or 'sprung' bands; by maintaining assembler

adjustments so that snug lines cannot be set; and by regularly cleaning justification bars so bands will not be skidded."

(3) "Apart from regular maintenance of bands and machine functions, we have found it a good investment to completely replace all bands each year."

(4) "The burrs that often develop on the bottoms of wedges from justification constituted a problem until we realized that these burrs must be periodically filed. Otherwise, these rough edges continue to strike the right side of mats in the assembling elevator and ultimately result in hairlines."

(5) "Quadders can be one of the causes of spaceband fouling as there is often little or no spaceband drive wth its attendant cleaning action. The tendency to use too few bands when using a quadder must also be avoided. A general awareness of the differing influence on spacebands when quadders are used can prevent many problems that might otherwise develop."

(6) "To eliminate any spaceband difficulties, it is of prime importance that bands not be allowed to accumulate metal deposits. Any spaceband that does will soon break down the sidewalls on many matrices, both directly and as the result of a chain reaction among mats. If vise jaws are replaced when necessary, if molds are not allowed to warp, if lockup adjustments are maintained, and if spacebands are properly and regularly cared for, metal accumulation will be negligible. Spacebands must be cleaned at intervals *before* accumulation occurs. This could mean every four hours. Defective or otherwise questionable bands should be immediately replaced."

In concluding, suffice to say that if matrices are the "lifeblood" of the linecasting machine, then perhaps the spacebands can be considered the indispensable *ducts* through which the lifeblood is enabled to effectively perform its task without damage or delay!

Directory of Related Manufacturers and Suppliers

Ad Space Products Co.
11 West 42nd Street
New York, New York

Allied Matrix Processing Corp.
P.O. Box 250
Braintree, Massachusetts

Baltimore Type & Composition Corp.
15 Frederick Street
Baltimore 2, Maryland

Bayport Chemical Co.
4500 West 44th Street
Minneapolis 24, Minnesota

Canadian Linotype Ltd.
829 Oxford Street
Toronto 18, Ontario

Central Type & Supply Co.
1711 Vine Street
Philadelphia 3, Pennsylvania

Conti Engravers
3801 East First Street
Fort Worth, Texas

Joseph Dixon Crucible Co.
167 Wayne Street
Jersey City 3, New Jersey

Dominion Matrix Service
95 Stanley Avenue
Mimico, Ontario

Dow Chemical Co.
Midland, Michigan

Dri-Stain Products Co.
3421 Colfax Avenue "A"
Denver 6, Colorado

Ebonite Chemical Co.
2300 28th Avenue
San Francisco 16, California

J. J. Edwards
25 Williams Street
Boston 30, Massachusetts

The Elfo Co.
34 Armington Avenue
East Providence, Rhode Island

Federal Products Corporation
1144 Eddy Street
Providence 1, Rhode Island

Fisk Industries
130 West 46th Street
New York 36, New York

Richard R. Hammill
14 West 71st Street
New York, New York

Hartco Manufacturing Co.
224 Meade Street
Chester, Pennsylvania

Hartzell Machine Works
Market Street & Bethel Road
Chester, Pennsylvania

Albert Hausman
1035 Ridge Avenue
Philadelphia, Pennsylvania

Hedman Corp.
1158 West Armitage
Chicago, Illinois

A. E. Heinsohn Printing Supplies
1443 Blake Street
Denver, Colorado

Federico K. Hutzler
1133 Broadway
New York 10, New York

Intertype Company
360 Furman Street
Brooklyn 1, New York

Atlanta Agency:
124 Sixteenth Street, N.W.
Atlanta 13, Georgia

Boston Agency:
80 Federal Street
Boston 10, Massachusetts

Chicago Agency:
57 West Grand Avenue
Chicago 10, Illinois

Cleveland Agency:
55 Public Square
Cleveland 13, Ohio

Dallas Agency:
1804 Hi-line Drive
Dallas 7, Texas

Los Angeles Agency:
1945 Figueroa Street
Los Angeles 7, California

New York Agency:
800 Second Avenue
New York 17, New York

San Francisco Agency:
885 Bryant Street
San Francisco 3, California

Janesville Matrix Economy
1105 E. Milwaukee Street
Janesville, Wisconsin

Jetronic Industries, Inc.
Main & Cotton Streets
Philadelphia, Pennsylvania

Oscar R. Kolen
5315 Venice Boulevard
Los Angeles 19, California

Ludlow Typograph Co.
2032 N. Clybourn Avenue
Chicago 14, Illinois

C & E Marshall Company
1445 W. Jackson Boulevard
Chicago 7, Illinois

Mat Jig
4966 Hamilton Street
Omaha 31, Nebraska

Mat Retrievers, Inc.
400 Lakeside Avenue, N.W.
Cleveland 13, Ohio

Matrix Contrast Corporation
154 West 14th Street
New York 11, New York

Mats, Inc.
Hudson Terrace
Marlboro, New York

Mergenthaler Linotype Company
29 Ryerson Street
Brooklyn 5, New York

Atlanta Agency:
300 Luckie Street, N.W.
Atlanta 13, Georgia

Boston Agency:
1137 Park Square Building
Boston 16, Massachusetts

Chicago Agency:
531 Plymouth Court
Chicago 5, Illinois

Dallas Agency:
1304 Dragon Street
Dallas 7, Texas

Los Angeles Agency:
1212 Albany Street
Los Angeles 15, California

San Francisco Agency:
155 Twelfth Street
San Francisco 3, California

Midwest Matrix & Machinery Mart, Inc.
633 Plymouth Court
Chicago 5, Illinois

Modern Matrix Co.
P.O. Box 192
Grantsburg, Wisconsin

Montgomery Co., Inc.
P.O. Box 309
Towanda, Pennsylvania

D. W. Morgan
1023 Vista Grand
Milbrae, California

Ralph H. Mort Company
2505 Southeast 11th Avenue
Portland 2, Oregon

Napman Associates
(See Allied Matrix Processing)

New England Lino-Matrix Service
431 Cambridge Street
Allston, Massachusetts

Parko Company, Inc.
108 Bissel Street
Joliet, Illinois

Progressive Brass Die Co.
118 West Pratt Street
Baltimore, Maryland

Quality Control Corp.
10 Depot Plaza
White Plains, New York

Seymour M. Rabin
469 Broadway
New York, New York

William Reid Co.
2271 Clybourn Avenue
Chicago 14, Illinois

Rich & McLean, Inc.
345 Carnegie Avenue
Kenilworth, New Jersey

Service Engravers
692 Broadway
New York 12, New York

Star Parts, Inc.
2 South Main Street
South Hackensack, New Jersey

Superior Linotype
P.O. Box 44
Parksville, Missouri

Type & Press of Illinois, Inc.
3312 North Ravenswood
Chicago, Illinois

Wiebking Engraving Co.
1158 West Armitage
Chicago, Illinois